45 ROAD FOREST RESTORATION UNIT
SITE MANAGEMENT PLAN
CEDAR RIVER WATERSHED

SEATTLE PUBLIC UTILITIES
WATERSHED MANAGEMENT DIVISION
ECOYSYSTEMS SECTION

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EXECUTIVE SUMMARY

The 45 Road Forest Restoration Unit (the Unit) is located along the western border of the Cedar River Watershed 0.25 miles from the Landsburg Diversion Dam, outside the hydrologic basin contributing to the municipal water intake. The Unit consists of 321 acres, of which 157 will be ecologically thinned and 164 will be leave areas. Sixty-seven of the 157 thinned acres will be restoration planted. There is one small wetland present, with no streams or other special habitats of concern. A cultural resources survey on the 157 acres designated for thinning identified two isolated lithic artifacts; thinning is not expected to have an adverse effect on cultural resources.

The Unit is dominated by small (<20 inch) 70 year-old Douglas-fir (*Pseudotsuga menziesii*) trees, with a relatively dense salal (*Gaultheria shallon*) understory. Current species and structural diversity is low. Laminated root rot (*Phellinus weirii*) is present throughout the Unit, with the northern section more heavily affected than the remainder. Gaps created by the root rot, which kills some conifers, provide horizontal structural diversity. Goals from the Cedar River Watershed Habitat Conservation Plan that apply to this Unit are to accelerate the development of late-successional forest characteristics, provide wildlife habitat for targeted species, and enhance natural biological diversity. Specific management objectives are: 1) maintain or increase the growth rate of trees, 2) increase structural diversity, 3) increase species diversity, 4) facilitate maintenance and recruitment of large-diameter snags and coarse woody debris, 5) protect special habitats, and 6) protect water quality. Prescribed silvicultural treatments designed to achieve these objectives include ecological thinning and restoration planting.

The Unit was divided into four Thinning Areas and four Leave Areas. The silvicultural prescription for each Thinning Area is based on the current tree density, size, and species composition, combined with site-specific objectives. Ecological thinning will use a variable density method, where trees in all size classes will be retained, with variable (rather than uniform) spacing between trees. This treatment is designed to simulate natural processes such as tree death from senescence, windthrow, lightning, and other small-scale disturbances characteristic of late-successional forests. Restoration planting and associated site preparation will occur in two of the Thinning Areas to increase biological diversity. Twenty-five percent of the trees per acre, which corresponds to 25 percent of the basal area on this Unit, will be removed from the Thinning Areas to achieve the ecological objectives. An estimated 677 thousand board feet or less will be removed, and surplus logs will be sold.

Leave areas are designed to 1) protect the wetland; 2) retain some existing root rot pockets to monitor the patchy successional dynamics; 3) retain areas with larger trees that would not benefit from thinning; 4) minimize potential for the chance of soil erosion; and 5) establish control areas for purposes of monitoring.

Three types of monitoring will be conducted. Compliance monitoring will ensure that contract specifications are met. Effectiveness of the silvicultural treatments in achieving the objectives will be evaluated using a series of 17 vegetation plots (ten in thinning areas and seven in leave areas). Determining site use by indicator wildlife species representative of late-successional conditions, such as forest dwelling bats, may validate that the objective of accelerating late-successional forest characteristics is being achieved.

1.0 INTRODUCTION

1.1 Background

The Cedar River Watershed (CRW) is the larger of two municipal watersheds that serve the City of Seattle (City of Seattle 2000). This watershed supplies 67 percent of the high quality drinking water provided to approximately 595,000 homes and businesses in Seattle and roughly 30 neighboring cities, towns, and water districts. The City owns virtually the entire 90,546-acre CRW upstream of the Landsburg Diversion Dam, where drinking water is diverted from the Cedar River. To protect water quality, unsupervised access is not allowed within the CRW. The watershed is 95 percent forested and is currently managed under a 50-year, multi-species Habitat Conservation Plan (CRW-HCP), which was signed in April, 2000. "The overall goal of the HCP is to implement conservation strategies designed to protect and restore habitats of all species of concern that may be affected by the facilities and operations of the City of Seattle on the Cedar River, while allowing the City to continue to provide high quality drinking water and reasonably priced electricity to the region." (CRW-HCP: 2.4-43). The watershed is being managed as an ecological reserve using an ecosystem approach, with the goals (among others) of protecting and restoring aquatic, riparian, late-successional, and old-growth habitats. No timber harvest for commercial purposes will be conducted under the CRW-HCP, but restoration using silvicultural manipulations, including thinning and planting, will be done to achieve ecological objectives.

This document is the management plan for the 45 Road Forest Restoration Unit (the Unit), the first ecological thinning conducted under the CRW-HCP. It includes a statement of the authority for such actions, site description, desired future conditions, ecological objectives, planned and potential future prescribed silvicultural restoration treatments (ecological thinning and restoration planting), and monitoring plans. See Sections 5.1.3 and 5.2.3 for detailed descriptions of the silvicultural treatments. A glossary is included as Section 9.0.

1.2 Authority

The CRW-HCP identifies some of the watershed management goals and objectives that apply to upland forest:

"The mitigation and conservation strategies for watershed management are designed to avoid, minimize, or mitigate for the impacts of any taking of listed species, including the spotted owl and marbled murrelet, and for the equivalent of taking of unlisted species addressed by the HCP. These strategies are also designed to provide a net benefit for the species addressed by the plan, contribute to recovery of these species, and contribute to the maintenance of natural biodiversity (see glossary) in the watershed and region. The strategies will also benefit many other fish and wildlife species inhabiting the biological communities and ecosystems of the watershed that are not specifically addressed by this HCP. Because this HCP focuses on species dependent on late-successional and old-growth forest, riparian and aquatic habitats, those species that depend primarily on the earliest seral forest habitat, such as the grass-forb-shrub stage of succession, will receive less benefit from the HCP or will lose habitat under the HCP, as these habitats will be less common than they are today." (CRW-HCP: 4.2-10)

"The general conservation objectives for watershed management are to:

- Develop strategies for watershed management, consistent with water supply functions, that protect and improve water quality, as well as aquatic and riparian habitats;
- Develop scientifically sound conservation strategies for the watershed that combine mitigation, protection, restoration, research, monitoring, and adaptive management to achieve the conservation objectives of the HCP;
- Develop strategies to restore and sustain the natural processes that create and maintain key habitats for species addressed by the HCP and that foster natural biological diversity of native species and their communities;
- Protect existing old-growth forest in the municipal watershed and promote development of additional mature and late-successional forest that will better support the native organisms characteristic of late-successional and old-growth forest communities;
- Develop an integrated, landscape approach that addresses the spatial relationship of habitats within the watershed and with regard to nearby areas to improve the ability of the watershed, over time, to support the species addressed by the HCP;
- Pursue land management approaches that, as practicable, help avoid catastrophic events such as forest fires that would jeopardize drinking water or habitats for species addressed by the HCP;
- Protect special habitats in the municipal watershed; and
- Commit not to harvest timber for commercial purposes, effectively establishing the forests in the watershed as an ecological reserve that will protect existing old-growth forest, recruit a significant amount of mature and late-successional forest, and make a significant contribution to the support of regional populations of species that depend on late-successional and old-growth forests and/or aquatic and riparian ecosystems." (CRW-HCP: 4.2-10-11)

The CRW-HCP divided the undeveloped habitat in the CRW into three major components and developed conservation measures for each. The components are 1) late-successional and old-growth forest communities, 2) aquatic and riparian ecosystems (e.g., streams, wetlands, forested riparian corridors), and 3) special habitats (e.g., talus/felsenmeer slopes, upland meadows, cliffs, etc.). Of the 90,546 acres in the CRW, 85,277 acres are forested, 2,914 acres are in the aquatic and riparian component, 1,809 acres are in the special habitats component, with the remainder developed. Of the forested acres, 13,980 acres are already in late-successional or old-growth conditions (>120 years old). The remaining 71,297 acres are available for recruitment into the late-successional forest habitat component (CRW-HCP: 4.2-15).

1.3 HCP Upland Forest Goals

The overriding goal of the HCP is to protect water quality for the municipal drinking water supply. In addition, numerous other goals are delineated in the HCP. Four general management goals that apply to the 71,297 acres of upland forest are to 1) accelerate the development of late-successional forest characteristics, 2) provide wildlife habitat for targeted species, 3) enhance natural biological diversity and 4) help avoid catastrophic events. The goals of accelerating the development of late-successional forest characteristics, enhancing biological diversity, and providing habitat for late-successional forest dependent wildlife species are intertwined. Restoration treatments are designed to accelerate development of late-successional characteristics, including large trees, structural and species diversity, heterogeneity, and standing and down dead wood. The treatments will both create and maintain mosaics of habitats over a range of spatial and temporal scales, providing wildlife habitat for a variety of native wildlife species and facilitating biodiversity. While disturbances on many spatial and temporal scales are natural components of forest ecosystems in the Pacific Northwest (e.g., windthrow, forest fire, disease and insect infestations), large-scale catastrophic disturbances may negatively impact water quality and wildlife habitat for species of concern in the CRW-HCP. As a result, if the risk is considered to be significant, some restoration treatments may be designed to reduce that risk.

1.4 HCP Upland Forest Management Activities

The CRW-HCP identifies three primary management activities to achieve the upland forest restoration goals. "Ecological Thinning" consists of thinning forest stands older than 30 years, with a primary goal of accelerating the development of late-successional forest characteristics. Examples of how thinning may be used to achieve this goal includes creating light gaps, encouraging understory development and promoting the growth of large trees. Snags, downed logs (referred to in this document as coarse woody debris, CWD), and tree cavities may be created where it is determined that these attributes are deficient. "Restoration Planting" will be conducted to develop a diversity of tree, shrub, forb, bryophyte, and lichen species characteristic of naturally regenerated stands, which should support a wide range of native wildlife species. Lastly, "Restoration Thinning" is the thinning of dense forest stands generally less than 30 years of age that have relatively low biological diversity. The goals are to reduce competition, increase light penetration, stimulate tree growth, reduce fire hazard, and accelerate forest development to a more biologically diverse stage.

1.5 Site Selection

The 45 Road Unit was selected because it is representative of more than 3,000 acres of second-growth Douglas-fir forests growing on droughty soils on plateaus near the Cedar River at lower elevations in the CRW. As a result of historic logging and wildfires, small diameter Douglas-fir trees dominate these low productivity sites that currently support limited structural heterogeneity and low biological diversity. These sites are not effectively developing towards desired late-successional wildlife habitat. Silvicultural techniques such as ecological thinning and planting can help these low productivity sites develop late-successional forest conditions more rapidly. Low elevation late-successional habitat in the Puget lowlands is increasingly rare, and documenting how restoration activities accelerate late-successional conditions on this representative Unit will provide valuable information supporting regional forest restoration. Monitoring the results of the silvicultural techniques and prescriptions used on this Unit will allow watershed scientists to evaluate, adaptively modify, and apply them to portions of the remaining 2,700 acres.

The overstory trees on the Unit are in the stem exclusion stage, competing for limited water, nutrients and light (see Section 2.8.1). This competition is slowing the growth rate of the trees, thereby limiting the development of large live trees and eventual recruitment of large snags and CWD. In addition, the dense salal understory limits establishment of a diversity of species of trees, understory shrubs, and herbs, which subsequently limits structural development on the site. Restoration activities delineated in the CRW-HCP are expected to accelerate the development of late-successional characteristics on this site, benefit wildlife species, and foster greater biological diversity. The Unit was selected as a management site containing Thinning Areas (Thinning

Areas 1 and 2), Thinning and Planting Areas (Thinning Areas 3 and 4), and Leave Areas (Leave Areas 1-4) designed to increase diversity throughout the forest stand (Figure 1).

Another factor in selecting this site was that it had no streams and is located outside of the hydrologic basin contributing to the municipal water supply intake at the Landsburg Diversion Dam. This location should ensure that the first ecological thinning under the CRW-HCP will have no negative effect on municipal water quality either from soil erosion or increased elk populations (which may be attracted to the project due to increase availability of forage materials). In addition, the Unit is located in close proximity to other restoration projects and has easy access from a nearby public road. This physical location allows the public to easily view a forest restoration project from a county road and also allows CRW staff to conduct tours for visitors to demonstrate the various restoration techniques being implemented under the CRW-HCP.

2.0 SITE DESCRIPTION

2.1 Location

The Unit encompasses 321 acres, of which 164 acres are in four Leave Areas and 157 acres are divided into four Thinning Areas (see Section 5.1) (Figure 1). The Leave Areas were delineated to protect special features of the forest, such as areas of large diameter trees, well developed gaps from laminated root rot, and a small wetland, as well as to provide control areas for monitoring and research. The thinning areas were designated for treatment based on their relatively high tree density and homogenous forest conditions and structure.

The Unit is located along the western border of the CRW in Sections 18 and 19 of T22N, R7E, W.M, and is bounded on the north by the 40 Road, on the west and southwest by the 45 Road, and on the east by the 43 Road and a tagged boundary line. The 45 Road parallels the watershed boundary and 276th Ave SE, a county road that is outside of the CRW, adjacent to the boundary. The site is located roughly 4 miles south of the community of Hobart, 5 miles northeast of the town of Black Diamond, 3 miles east of Maple Valley, and 11 miles southwest of the town of North Bend (Figure 2). The Landsburg Diversion Dam is approximately 0.25 miles to the southeast.

2.2 Landscape Context

While forest within the watershed will not be commercially harvested during the 50-year term of the CRW-HCP, forested land outside and adjacent to the CRW is subject to continued rotation harvest or conversion to other landcover types. Private, rural residential properties dominate much of the area to the north and west (Figure 2). The capped Hobart Landfill is located immediately west and across 276th Ave SE. The Landfill is managed by King County and consists of 46 acres of open, grassy habitat. Publicly owned forest lands in the vicinity include Tiger Mountain State Forest (3.0 miles north and greater than 13,000 acres), Taylor Mountain County Forest (4.0 miles north and 1,725 acres), Rattlesnake Mountain Scenic Area (8.0 miles northeast and 1,771 acres), and the Mt. Baker-Snoqualmie National Forest (12.5 miles east and 1.7 million acres). The nearest area containing late-successional forest is 3.8 miles northeast. Puget Sound is approximately 17 miles to the west.

2.3 History and Cultural Resources

Historic Native American use in the CRW has been well documented, although no historic villages or camps have been identified on the Unit itself. Archeological sites and a prehistoric trail are located along the Cedar River, which at the closest point runs within roughly 450 feet of the Unit. The area may have been used for travel, hunting, and/or gathering of resources, activities that can leave little or no permanent record. American settlers moved into the area near the Unit in the 1800s, largely to exploit the timber and mineral resources. Many homesteads and settlements were located in the vicinity, although there is no record of historical sites on the Unit. The City of Seattle acquired the property in the early 1900s, while condemning private property in the CRW for the protection of Seattle's water supply. The Unit was clearcut logged in 1911, which may have been followed by burning to remove logging debris. Large fires were documented in the CRW in 1927-28, and may have burned the Unit at that time. The area was likely naturally reseeded, but no documentation of burning or reseeding is available specifically for this site. The current forest averages 70 years old, originating about 1932.

A cultural resources survey was conducted in 2001, covering the 157 acres designated for ecological thinning (Thinning Areas 1-4, Figure 1). The survey consisted of 110 parallel pedestrian transects and the excavation of 1,755 shovel probes (30 cm diameter and 20-30 cm depth) on a 20 m grid. A total of two isolated lithic artifacts (one chalcedony basal-notched projectile point and one debitage consisting of a small jasper pressure flake), eleven springboard notched tree stumps, and a segment of a historic line of transportation (either a rail line or a road) were identified. Ecological thinning is not expected to have an adverse effect on cultural resources (Herbel and Schalk 2002).

2.4 Soils

The soil type in the Unit is Barneston gravelly coarse sandy loam in the Barneston-Klaus-Skykomish general soil class (USDA-SCS 1992). This soil is "somewhat excessively drained" and is formed in glacial till or outwash terraces, sometimes with volcanic ash and loess. Erosion potential for this soil is slight. It typically supports an overstory vegetation of Douglas-fir, western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and red alder (*Alnus rubra*), and an understory of salal, western sword fern (*Polystichum munitum*), Oregon-grape (*Berberis aquifolium*), and vine maple (*Acer circinatum*). This soil type generally supports limited tree height growth because of its droughty, infertile nature. On a 100-year site curve, the mean site index for Douglas-fir on this soil is 135 feet, and on a 50-year site curve is 105 feet. The site class for this site is Site Class IV, with Site Class I being the best and Site Class V being the poorest for tree growth.

2.5 Elevation and Topography

Elevation ranges from 614 to 675 feet above sea level, with slope varying from 0-13 percent (Figure 1). A topographic break runs east to west across the middle of the Unit and descends abruptly approximately 40 feet in elevation from north to south. A flat-topped hill located in the center of the Unit rises about 40 feet from the surrounding area and encompasses 3.7 acres. Finally, there is another east/west topographic break of about 40 feet at the very southern tip, near the Road 43/45 junction. The remainder of the Unit is flat.

2.6 Climate

The climate is typical of weather on the west side of the Cascade Mountain Range in Washington. The nearest weather station is located at the Landsburg Diversion Dam (data available at: http://www.wrcc.dri.edu). Temperatures at Landsburg range from an average monthly maximum of 75°F in July, to an average monthly minimum of 31°F in January. Annual average precipitation is 57 inches, falling primarily as rain from November to March. Annual snowfall averages 10 inches.

2.7 Aquatic Resources

The northern section of the Unit generally drains subsurface northwest into the Walsh Lake Diversion Ditch, while the southern section drains subsurface southwest into the Cedar River downstream from the Landsburg Diversion Dam (Figure 2). The 3.7-mile Walsh Lake Diversion Ditch was constructed in 1931 to divert low quality water from mines and townsites in the Walsh Lake drainage area to a point approximately 1.5 river miles downstream of the water supply intake at the Landsburg Diversion Dam. Because the Unit lies outside the hydrographic boundary of the CRW, management is not expected to directly impact the City's water supply or water quality. The Cedar River ultimately flows into Lake Washington approximately 22 river miles downstream of Landsburg.

2.7.1 Streams

There are no surface streams present in the Unit. The nearest stream is the Walsh Lake Diversion Ditch, a Type F (interim Type 3 – see glossary) stream located approximately 170 feet north of the Unit and north of the 40 Road. The Cedar River, a Type S (interim Type 1) stream, flows approximately 450 feet west and 700 feet south of the Unit. Neither stream is expected to be impacted by restoration activities on the site.

2.7.2 Wetlands

There is one wetland in the Unit that contains standing water for much of the year but can go dry during the summer. It is located adjacent to and just west of the 45 Road and opposite the Hobart landfill. The circular wetland is roughly 100 feet in diameter or about 8,000 ft^2 (0.2 acre). It is situated in a semi-circular depression 20 to 30 feet below the surrounding forest. The depression may have formed during the deposition of the glacial outwash in which it occurs. The wetland appears to be primarily sustained by groundwater, but a 12-inch culvert also feeds into it from under the 45 Road. Based on the distribution of shrub species to the east (salal) and west (red-osier dogwood, *Cornus sericea*) of the wetland, the groundwater flow appears to be primarily from the west. The culvert appears to have flow only when the ditch between the 45 Road and 276th SE fills with water. On February 6, 2001, the ponded area occupied approximately 600 ft^2 and was up to three feet deep.

Vegetation around the ponded water consists of two substantial patches of sedge (*Carex* sp.) and several species of shrubs, including spirea (*Spiraea douglasii*), Pacific ninebark (*Physocarpus capitatus*), clustered wild rose (*Rosa pisocarpa*), and red-osier dogwood. Young alder and black cottonwood (*Populus trichocarpa*) saplings are also present. Trees in and immediately around the wetland include numerous large (>100 ft tall) cottonwoods and a few alder. The surrounding forest is primarily composed of Douglas-fir, with a few western red cedar and western hemlock. The understory of the forest is dominated by salal. There are several large Douglas-fir snags near the wetland that may have been killed during periods of high water. Numerous pieces of CWD are also present in and around the wetland. Openings in the forest (gaps caused by laminated root rot) are evident to the north and east of the wetland.

Wetlands are scarce in the immediate vicinity of the Unit. Because this wetland is located in close proximity to both closed canopy forest and open grassy habitat (i.e., the Hobart Landfill outside of the CRW), it likely provides important local habitat for numerous wildlife species, including several species of large and small mammals, amphibians, and birds (Appendix I). During February 2001, a salamander (likely a northwestern salamander (*Ambystoma gracile*)) was observed in the pond, and hairy woodpeckers (*Picoides villosus*) were seen foraging on snags in the wetland. During 2002, Pacific tree frog (*Hyla regilla*) were documented breeding in the wetland, and numerous bats were recorded foraging over it.

2.7.3 Special aquatic areas
No special aquatic areas, such as springs, occur in this Unit.

2.8 Vegetative Resources
The Unit lies in the Western Hemlock Zone (Franklin and Dyrness 1988) in the western foothills of the Cascade Mountains. Prior to American settlement in the region, this zone was subject to natural disturbances such as windthrow, disease and insect infestation, and catastrophic forest fires. Typical fire-return intervals in this area of the western Cascades range from one to several hundred years (Agee 1993, Morrison and Swanson 1990).

2.8.1 Overstory
The current forest is dominated by 70 year-old Douglas-fir that originated in 1932 following logging in 1911 and burning thereafter. Much of the forest currently exhibits little canopy differentiation or vertical structure and is characteristic of Douglas-fir trees of this age growing on low-quality sites. Forest structure is typically slow to develop in these types of forest, and may be relatively simple, even in mature forests.

A timber cruise of the 157 acres designated for ecological thinning in the Unit (Thinning Areas 1-4, Figure 1) was completed in September 2001 (Appendix II). Eighty plots were measured (approximately one every two acres), using a variable plot cruise method. The cruise estimated an average of 200 live trees/acre on the site (192 Douglas-fir, 7 western hemlock, and 0.6 western red cedar). Of the Douglas-fir, 77 percent ranged from 6 to 14 inches diameter at breast height (dbh), and 96 percent were below 20 inches dbh. The largest Douglas-fir measured was 32 inches dbh. Eighty-seven percent of the western hemlock ranged from 7 to 14 inches dbh, with the largest measured at 22 inches. Only one 10-inch western red cedar was included in the sample. All of the Douglas-fir trees established as a single cohort approximately 70 years ago, while the scattered western hemlock and western redcedar established more recently. The Douglas-fir crowns comprise one relatively shallow canopy layer, while the shade-tolerant trees have full crowns that typically extend to the forest floor.

Dominant and intermediate Douglas-fir trees were cored with an increment borer to verify tree ages and relative growth rates in the Unit. Tree ages ranged from 65-75 years old, with a few scattered legacy trees (as defined in the CRW-HCP, see glossary) over 160 years old. At their current growth rates, the dominant second-growth Douglas-fir trees will gain one inch in radial growth every eight to 14 years, while the intermediate trees will gain one inch of radial growth in 20 years or more. Substantial competition among overstory Douglas-fir trees is indicated both by reduced growth rates in the last 20 years, especially in subdominant trees, and by competition mortality as evidenced by snags.

2.8.2 Understory

Field observations of the Unit in 2001 indicated the understory was dominated by salal, with some Oregon-grape, red huckleberry (*Vaccinium parvifolium*), sword fern, vine maple, trailing blackberry (*Rubus ursinus*), bracken fern (*Pteridium aquilinum*), ocean spray (*Holodiscus discolor*), sedge, grass and mosses present. Few understory trees saplings or seedlings were observed.

Understory vegetation data were collected as a supplement to a forest inventory conducted between 1992-94 designed to sample forest stands in CRW between 40 and 100 years old (Mason, Bruce, and Girard 1992). This survey documented that salal dominated the Unit and the surrounding vicinity at that time, with 84 percent of the plots in the Unit having ≥69 percent cover by salal (Table 1). Vine maple was the only other species that had any plots in the ≥80 percent cover class, and that consisted of only 8 percent of the plots in the Unit. The majority of other shrubs measured were in the lower cover class categories.

Table 1

Percent of plots covered by understory species, by cover class[a], in the 45 Road Forest Restoration Unit[b], and in the vicinity[c], 1992-94 study

Species	≥80% Cover		60-79% Cover		40-59% Cover		20-39% Cover		<20% Cover	
	In Unit	In Vicinity	In Unit	In Vicinity	In Unit	In Vicinity	In Unit	In Vicinity	In Unit	In Vicinity
Salal	44	49	40	37	4	17	8	7	0	0
Oregon Grape	0	0	0	0	20	15	16	22	40	37
Sword Fern	0	0	4	5	0	2	16	10	44	37
Red Huckleberry	0	0	0	0	4	2	20	22	44	37
Vine Maple	8	5	16	12	8	5	12	22	0	2

[a] Because shrub species overlap, and not all species occurred on all plots, percentages do not add to 100.
[b] 25 plots = 1.25 ac sampled
[c] 41 plots = 2.05 ac sampled

Salal is a typical understory shrub on low productivity sites. The dominance of salal in the Unit is most likely a factor in limiting the establishment of a diverse understory. The restoration planting component of this management plan aims to increase diversity of conifer and deciduous trees in the Unit.

2.8.3 Biological Legacies, Snags, Stumps, and CWD

There are several legacy trees >35 inches dbh and >150 years old in the Unit that were likely left after the 1911 logging. These older trees contribute vertical structure that is currently limited in this forest. Some of these trees exhibit structural characteristics such as dead tops, forks, stem decay, and broken branches that are associated with a history of wind and fire damage; these features provide valuable wildlife habitat and biological diversity. The decayed stumps that remain on the site rarely exceed 40 inches dbh, which likely indicates that prior to harvest, trees on the site reached a maximum diameter of about 40-45 inches dbh.

One legacy Douglas-fir tree was cored and was determined to be over 160 years old. This tree had an interesting growth pattern over its lifetime and demonstrated that significant release is possible, even on such low productivity sites. The tree had relatively slow and even growth until it was 80 years old, and averaged one inch of diameter increment every 20 years. Given its slow initial growth, it was probably an intermediate tree in the original forest. When the tree was about 90 years old (about 1930, approximately 19 years after the forest was logged), it experienced a significant increase in growth and gained about one inch in diameter increment every seven years. At about 113 years old, the tree's growth slowed again and currently averages one inch diameter increment every ten years. This old, dominant Douglas-fir is still actively growing on this Unit.

Few large-diameter snags (≥30 inches dbh) are present in the Unit, which is likely the result of the timber harvest in 1911 and the burning that followed. It is also possible, however, that this site contained few large snags prior to harvest, because the low productivity of the area simply may not support many large-diameter trees. Currently, most snags in the Unit are of small diameter and associated either with competition mortality or pockets of laminated root rot. Snags created from competition mortality typically remain standing for a relatively short time because of their small diameter and fairly rapid decay rate. Although small-diameter snags are used for foraging by a wide variety of wildlife species and nesting by some (e.g., hairy woodpecker), they may be of insufficient size to function as nest sites for larger species. The largest density and diameter snags in the Unit are associated with the root rot pockets in Leave Area 1 (Figure 1), where the disease has killed all of the trees in some areas, including the largest dominants (see Section 2.8.4). Some of these snags are larger than 17 inches dbh, providing valuable habitat for several cavity nesting species. The longevity of snags created by root rot may be relatively limited, however, because decreased root and butt strength predisposes them to instability and windthrow.

The 1992-94 forest inventory (Mason, Bruce, and Girard 1992) estimated that there were 0.8 snags/acre that were >20 inches dbh, with a total of 13.6 snags/acre (Table 2). The same study estimated 4.8 stumps/acre that were >30 inches dbh, with a total of 20 stumps/acre. The 2001 cruise data of the 157 acres designated for ecological thinning (Thinning Areas 1-4, Figure 1) estimated an average of 15 Douglas-fir snags per acre (Appendix II). A total of 20 snags were measured, with 36 percent 6-8 inches dbh, 47 percent 8-12 inches dbh, and 16 percent 12-18 inches. The largest snag measured in 2001 was 18 inches.

Table 2
Summary of snag and stump data from plots sampled on the
45 Road Forest Restoration Unit[a] and in the vicinity[b], 1992 study

Habitat Element	Diameter Class	# Sampled in Unit	Estimated #/acre in Unit	# Sampled in Vicinity	Estimated #/acre in Vicinity
Snags	> 20" dbh	1	0.8	2	1.0
Snags	8 – 20" dbh	6	4.8	10	4.9
Snags	<8" dbh	10	8.0	17	8.3
Stumps	≥30" dbh	6	4.8	9	4.4
Stumps	20 – 29" dbh	7	5.6	11	5.4
Stumps	10 – 19" dbh	10	8.0	13	6.3
Stumps	<10" dbh	2	1.6	3	1.5

[a] 25 plots = 1.25 ac sampled
[b] 41 plots = 2.05 ac sampled

In 2001 the amount of CWD varied throughout the site, with very few large-diameter logs (≥30 inches) seen in the Unit. Most of the CWD was associated with the root rot pockets, with the majority less than 24 inches in diameter. A survey conducted by watershed staff found that the average diameter of CWD in root rot pockets was seven inches, most of which was moderately decayed (decay class 3) and was suspended above the ground. Outside of the root rot pockets where competition mortality predominates, the average diameter of CWD was eight inches and more than half of the CWD was in contact with the soil. Overall, there were twice as many pieces of CWD in the root rot pockets than in the remainder of the forest stand.

2.8.4 Laminated Root Rot

Laminated root rot is present throughout the Unit, but Leave Area 1 is much more heavily affected than the Thinning Areas. Root rot primarily infects and kills Douglas-fir and western hemlock trees that are environmentally stressed. On this poor quality site, stress is caused by droughty soils and tree density (competition). Root rot can be ecologically beneficial because it creates biological diversity in an otherwise simple forest by increasing the number of snags, amount of CWD, and creating gaps in the canopy. Canopy gaps in the Unit range from less than 0.25 acre to one patch in Leave Area 1 greater than six acres. The gaps provide increased horizontal structural diversity and facilitate the development of species diversity. Resistant and immune species that may colonize infected areas include western red cedar, red alder, bigleaf maple (*Acer macrophyllum*), and vine maple. These colonizing trees and shrubs contribute to increased vertical diversity by creating intermediate canopy layers. Gaps are more prevalent in Leave Area 1 than in the Thinning Areas. Colonization by species including vine maple and western red cedar is occurring in Leave Area 1, but currently there is little or no colonization of the gaps in any of the Thinning Areas.

2.9 Wildlife Habitat

The second-growth forest in the Unit potentially provides habitat for a suite of wildlife species, including bats, small and large mammals, amphibians, and birds (Appendix I). As described above, most of the Thinning Areas consist of uniform, small-diameter Douglas-fir trees with a salal understory, providing little habitat or biological diversity. The more prevalent root rot pockets in Leave Area 1, however, provide a moderate degree of structural and species diversity, exemplified by the presence of western hemlock, western red cedar, alder, cottonwood, bigleaf maple, and several species of deciduous shrubs. The hill in Leave Area 1 generally has larger trees, with greater tree and understory species diversity, including species such as sword fern that indicate a moister site than on the rest of the Unit. The close proximity to the open grassy habitat provided by the capped Hobart Landfill increases the likelihood that the edges of the Unit will be used by early successional species. The presence of the wetland and the proximity of the Walsh Lake Diversion Ditch increase the chance that amphibian species such as northwestern salamanders will disperse into the upland areas of the Unit. The proximity to the county road, rural development, and the dam facilities at Landsburg makes it unlikely, however, that interior-dependent or disturbance-sensitive species will utilize the site.

In 2001, primary cavity excavators, including pileated (*Dryocopus pileatus*) and hairy woodpeckers, were observed foraging in the Unit. Snags, primarily Douglas-fir and alder, of all size classes showed extensive foraging use, and nest cavities were observed in snags as small as nine inches dbh. Signs of elk (*Cervus canadensis*) and black-tailed deer (*Odocoileus hemionus*) were also present, including numerous trails and bedding sites. The Unit appears to be used predominantly for ungulate travel, rest, and hiding cover, because there is limited forage available. Mountain beaver (*Aplodontia rufa*) and Pacific tree frog were observed on the hill. In 2002, black bear (*Ursus americanus*) sign was observed.

This forest stand lacks characteristics typical of late-seral forest, such as large-diameter trees, large-diameter snags, large-diameter CWD, a variety of berry-producing shrubs, mast-producing trees or shrubs, canopy layering, tree species diversity, and variable tree densities. Because 28 of the 83 species listed in the CRW-HCP are associated with late-successional forest habitat (the others requiring riparian or other “special” habitats), management actions facilitating the creation of these characteristics are a primary management goal. Native species not listed in the HCP are also considered during management as long as there are no conflicts with the overall goals of the CRW-HCP. A list of wildlife species that potentially could use the Unit, either now or in the future, along with key habitat elements the Unit might provide, is included in Appendix I. It is possible that the low productivity of the site may limit the structure of the future older forest, which may also limit wildlife species diversity. Accelerating this site to late-successional conditions, however, should provide valuable wildlife habitat and foster biological diversity, which is especially important in the local and regional landscape context.

2.10 Special Habitats

No special habitats (e.g., talus slopes, meadows), other than the wetland and pockets of root rot, occur on the Unit.

3.0 DESIRED FUTURE CONDITIONS

The desired long-term future condition of the Unit includes characteristics consistent with self-sustaining, late-successional conifer forests of the region that are subject to similar environmental constraints. These characteristics include large-diameter trees (likely about 40-45 inches dbh); small canopy gaps ($\leq$ 0.5 acre); a diversity of tree, shrub, forb, and bryophyte species; a variety of tree sizes and densities incorporating both horizontal and vertical structural diversity; and abundant large-diameter snags and CWD that occur in patches across the Unit, analogous to that seen in naturally functioning systems. These conditions should support a variety of native wildlife species over the short, intermediate, and long-term, including many of the 28 late-successional forest dependent species listed in the CRW-HCP, as well as fostering natural biological diversity (Appendix I).

4.0 ECOLOGICAL OBJECTIVES

Three of the forest management goals specified in the CRW-HCP apply to this Unit: 1) accelerating the development of late-successional characteristics, 2) providing wildlife habitat and 3) fostering natural biological diversity. Because much of the Unit currently has relatively low structural and species diversity for its age, prescribed silvicultural treatments (Section 5.0) will be used to achieve six ecological objectives (described below). Not all objectives will be achieved on all portions of the Unit, but the treatments are expected to create and enhance structural heterogeneity and biological diversity on the Unit.

Based on evaluation of current forest conditions and ecological processes that are presently occurring on the Unit (Section 2.0), this restoration project will use ecological thinning and planting to accelerate the development of the desired future conditions, and focuses on the six ecological objectives. The conceptual framework for this project is illustrated in Figure 3, which describes current forest conditions and processes, silvicultural interventions, key ecological processes that are amenable to influence, ecological objectives, and desired future conditions.

All conditions and processes on this Unit are influenced by low site quality. This low site quality intensifies the existing competition that is occurring among second-growth Douglas-fir trees, reducing tree growth (diameter increment) and tree vigor. In general, low productivity sites tend to languish in the stem exclusion successional stage (see Section 5.1.1) longer than high productivity sites, because the limited soil resources do not allow individual trees to efficiently out-compete other trees. Therefore, low productivity sites can greatly benefit from ecological thinning that reduces the competition among trees, thereby sustaining more rapid tree growth for longer periods of time. A low productivity site, such as this Unit, may never support the large tree sizes or biological diversity that could be attained on a higher productivity site. However, tree size and structural complexity on this Unit can be much greater than under current conditions and can contribute materially to the functionality of late seral forests in the landscape. The presence of scattered legacy trees indicates this Unit’s ultimate site potential. While the forest will respond within its constraints, the combination of ecological thinning and planting on this Unit is designed to maintain and, over the long-term, increase overstory tree growth while also accelerating understory development and overall forest structural and species diversity.

Because competition among trees is currently occurring on the Unit, the trees are reduced in vigor and are therefore more susceptible to laminated root rot. The root rot is increasing the structural heterogeneity, amounts of CWD, and understory diversity, especially in Leave Area 1. While this restoration project does not intend specifically manage the laminated root rot, it does attempt to increase the vigor of remaining Douglas-fir trees (by retaining the healthiest trees) and increase forest species diversity. Both of these objectives will serve to increase the forest complexity and better enable it to reach late-successional forest conditions more rapidly. The root rot will continue to develop structural heterogeneity and CWD on the Unit, thereby contributing to biological diversity.

Ecological thinning will reduce tree stress imposed by site constraints, competition, and root rot. The remaining trees will be able to maintain, and in some cases, accelerate growth. This continued growth will lead to larger live trees that will provide structural complexity (e.g., bark, branches, crown, roots), habitat value, and biological diversity. Ultimately, some of these large trees will be naturally recruited as large snags and CWD. Opening the canopy through ecological thinning will encourage the success of planting for diversity and increase understory development.

Low quality sites tend to support a dominant salal understory, which impedes diverse understory development. The low species diversity, dominated by Douglas-fir and salal, leads to reduced structural complexity, habitat value, and biological diversity. Restoration planting and associated site preparation (to reduce salal competition) will increase vertical heterogeneity. Planting root rot resistant and immune species will slow the progression of the root rot and provide more diversity on the Unit. Planting a variety of tree species will eventually provide diverse overstory trees and snags, thereby increasing habitat complexity and biodiversity. In addition, the large logs will provide substrate for the regeneration of shade-tolerant conifers (large "nurse logs") within the dense salal understory (Maser et al. 1988).

Objective #1: Maintain or Increase Growth Rate of Trees.
Competition for light, water, and nutrients has limited the growth rate and diameter of overstory trees on large portions of the Unit, slowing the development of this habitat element. By reducing the density of overstory trees the growth rate can either maintain or increase, rather than decrease, thereby accelerating the development of larger diameter trees (Smith et al. 1997). Because of the droughty soil, the tree density at which competition occurs on this site is less than would be seen on a high quality site. Although the maximum height of trees on the Unit may be limited by the poor soil development and droughty conditions, the diameter growth of the trees can be increased by lowering the tree density, effectively increasing the spacing between trees. Based on the size of legacy trees and stumps, it is expected that 40-45 inch dbh trees will eventually develop on the site.

Large-diameter trees are characteristic of late-successional forests. Cavities in large-diameter trees are required for nesting habitat by spotted owl (*Strix occidentalis*). Marbled murrelet

(*Brachyramphus marmoratus*) require large branches for nesting, habitat characteristics that generally develop only on large-diameter trees. The vertical structure provided by large emergent trees is important to certain bird species, such as the olive-sided flycatcher (*Contopus cooperi*) and several raptors. The deeply fissured bark that develops in older trees supports invertebrate communities, is used by bark-foraging birds such as brown creepers (*Certhia americana*), and can be used as roosting sites for many species of bats. In addition, larger trees support a variety of lichens and fungi that are important food sources for many small mammals, including the northern flying squirrel (*Glaucomys sabrinus*) (Johnson and O'Neil 2001).

Objective #2: Increase Structural Diversity.
A canopy containing large emergent trees and intermediate layers of trees, shrubs, and herbaceous vegetation provides vertical structural diversity that has not yet developed naturally in the Unit. Emergent trees on the site are limited, and intermediate canopy layers are generally lacking, especially in Thinning Areas 1 and 2. Ecological thinning will reduce the tree density, create variable spacing, and create less dense areas, allowing larger shrubs and smaller trees to establish and grow into intermediate canopy layer, providing vertical heterogeneity. Retaining snags and CWD on the Unit will further increase structural diversity. Horizontal structural diversity on this site is provided by canopy gaps created by laminated root rot (primarily in Leave Area 1), a natural process that contributes to overall structural diversity, tree and understory species diversity, and snag and CWD creation.

Structural diversity develops as the forest matures and is important for many species of wildlife, with different species utilizing different canopy layers. Ground foragers such as winter wren (*Troglodytes troglodytes*), spotted towhee (*Pipilo erythrophthalmus*), and most insectivores and rodents primarily use litter, CWD, and herbaceous plants on the forest floor. Species such as Wilson's warbler (*Wilsonia pusilla*) and Douglas squirrel (*Tamiasciurus douglasii*) use low and intermediate shrub and overstory tree canopy layers for foraging and nesting, and species such as golden crowned kinglet (*Regulus satrapa*) and forest deer mouse (*Peromyscus keeni*) primarily utilize the upper canopy. Spatial heterogeneity, including both areas of high vertical diversity of vegetation and areas of sparse understory, provides the variety needed for species such as spotted owl to locate, track, and attack prey, as well as perches from which they can pounce (Carey et al. 1999).

Objective #3: Increase Plant Species Diversity.
Although several native tree species typical of this forest type exist in the Unit, Douglas-fir trees overwhelmingly dominate the overstory (Appendix II). Understory development is limited on the site by the droughty soils, and most areas will likely continue to be dominated by salal. In areas of higher productivity and in canopy gaps, however, other understory species predominate, with canopy gaps in Leave Area 1 having the highest level of understory species diversity, including both vine maple and western red cedar.

A diversity of tree, shrub, and herbaceous species is characteristic of late-successional forests, and provides a wide range of habitat elements for native wildlife species. A variety of trees that have different timing of seed production provide a more stable and diverse food source for many species of birds and small mammals than would a single species. In addition, a variety of conifer and hardwood trees provides a range of growth rates and bark surfaces that contribute to the complexity of the forest and biodiversity (Johnson and O'Neil 2001), including epiphytes. Berry and flower producing shrubs are essential habitat elements for several wildlife species, including rufous hummingbird (*Selasphorus rufus*), red fox (*Vulpes fulva*), and band-tailed pigeon (*Columba fasciata*). Deciduous foliage provides substrate for foliar insects, which are a food resource for many bird and bat species. In addition, the presence of hardwoods appears to be a key habitat element for several species of birds, including olive-sided flycatcher, Pacific slope flycatcher (*Empidonax difficilis*), and downy woodpecker (*Picoides pubescens*). A variety of both conifer and hardwood leaves on the forest floor provides litter important to many invertebrates, insectivores, small mammals, and amphibians, as well as contributing to nutrient/carbon cycling and soil development.

Objective #4: Facilitate Maintenance and Recruitment of Large-diameter Snags and CWD.

Large volumes of large-diameter standing and downed dead wood are key characteristics of old-growth forests. Snags and CWD are not evenly distributed across old-growth forests, rather they tend to occur in patches. Snags are a vital habitat component for many wildlife species, ranging from cavity excavating species such as woodpeckers, to secondary cavity users, including several owl species (Thomas et al. 1979). Numerous bat species use large-diameter snags, especially at more advanced stages of decay (Christy and West 1993). Loose bark provides both day and night bat roosting sites, and cavities provide a stable microclimate for maternity colonies. Coarse woody debris, especially large-diameter logs, is used by numerous wildlife species, including amphibians, many small carnivores, and a myriad of insect species (Spies and Cline 1988). A large log is a primary growth substrate for many species of fungi and plant species (e.g., the "nurse log" phenomenon) (Cowling and Merrill 1966, Maser et al. 1988). Coarse woody debris is also crucial for carbon and nutrient cycling and water retention, functions especially important on dry sites such as this Unit (Harmon et al. 1986). While large-diameter snags and CWD (>30 inches dbh) are more persistent and can be used by a greater variety of wildlife species, smaller wood is still used by many species. Maintaining or accelerating tree growth will increase the potential for recruitment of large dead wood in the future. Additionally, current efforts to retain existing snags and augment large CWD on the Unit will provide these habitat values in the near term.

Objective #5: Protect Special Habitats.

Special habitats such as wetlands are important wildlife habitat. In the Pacific Northwest the majority of wetland habitat has been converted to other land uses, such as development and agriculture. Remaining wetlands have become increasingly critical refuge habitats, especially for dependent species, including pond-breeding amphibians such as northwestern salamanders and red-legged frogs (*Rana aurora*).

Another special habitat present on the Unit is the root rot pockets. The canopy gaps created by root rot provide a different microclimate from the surrounding forest. The greater amount of light reaching the forest floor can allow development of deciduous and berry-producing shrubs, grasses, and forbs, which benefit numerous bird, mammal and insect species (as discussed in Objective #3). Some gaps, especially in Thinning Area 1, may continue to be dominated by a monoculture of salal due to interference competition, a lack of seed source, and lack of a suitable substrate for establishment by other shrubs.

Objective #6: Protect Water Quality
Protecting drinking water quality is the primary management goal in the CRW. The Unit lies outside the hydrographic boundary of the CRW, which greatly decreases any risk of water contamination associated with restoration activities. Water quality issues associated with fecal contamination from elk and deer traveling from the Unit to the Cedar River, however, are a potential concern.

5.0 PRESCRIBED SILVICULTURAL TREATMENTS

5.1 Ecological Thinning

5.1.1 Overview

Forests in the Pacific Northwest develop through identifiable stages: 1) stand initiation or early-seral, 2) stem exclusion or mid-seral, 3) understory reinitiation or late-seral, and 4) shifting mosaic or old-growth (Franklin and Waring 1980, Oliver and Larson 1990). The stand initiation stage occurs as tree seedlings become established throughout the forest stand, either naturally or by planting, following a stand replacement event (e.g., clearcut harvest, forest fire). This stage can last for several decades. The stem exclusion stage occurs when the trees have grown to a size such that they are competing with one another for resources (e.g., sunlight, nutrients, and water). This stage generally occurs when the stand is 20 to 100 years old and results in decreased growth rate and significant tree mortality. The understory reinitiation stage occurs after tree densities have decreased, either through competition mortality or thinning, and the tree canopy opens to allow greater sunlight penetration to the forest floor. Understory plants and a new cohort of trees are then able to establish under the overstory trees. This stage generally occurs from 60 to 200 years old. The old-growth stage occurs when the dominant trees become very large and the understory is developed enough to have several layers (e.g., subdominant trees, saplings, seedlings, shrubs, and herbs). Shifting mosaic refers to the dynamics of the old-growth stage where dominant trees periodically fall to create canopy gaps. Tree growth and competition occurs within these gaps until dominance is reestablished. The old-growth stage generally occurs when a stand is greater than 180 years old.

Ecological thinning seeks to limit the competitive interaction between trees that would occur during the stem exclusion stage, while maintaining sufficient numbers of trees to retain it as a naturally functioning forested site (Figure 4). The goals are to shorten the stem exclusion phase, prevent stagnation, and accelerate the forest to the more biologically diverse understory reinitiation phase. Thinning should allow remaining trees to maintain or increase their rate of growth, while providing more sunlight for understory growth and seedling initiation. The old-growth stage is typically characterized by a variety of tree sizes and heterogeneous spacing between trees. Ecological thinning seeks to mimic this condition by leaving a variety of tree sizes, spacing, and densities throughout the forest, including leaving some areas unthinned. A variable density thinning method will be used, in which, in contrast to standard commercial thinning, trees across smaller size classes will be left, all larger diameter trees will be left, and variable (rather than uniform) spacing between trees will be created (Carey et al. 1999). This treatment is designed to simulate natural processes such as tree death from senescence, windthrow, lightning, disease, or insects, and other small-scale disturbances in late-successional forests. Though site potential is limited by poor growing conditions, ecological thinning should help achieve the objectives listed in Section 4.0.

Multiple mechanical entries onto a site can have several disadvantages. These include disturbance to wildlife, ground disturbance that can impact habitat in the short term, a possible decrease in site productivity in the long term due to soil compaction, and disturbance to mycorrhizal communities that can result in decreased sporocarp production for up to ten years after a thinning (Carey et al. 1999). It is expected that a single ecological thinning entry will accomplish the objectives defined in Section 4.0.

5.1.2 Treatments

Treatments to achieve Objective #1, Facilitate Growth of Larger Diameter Trees
Ecological thinning will reduce the current average density of 199 live trees/acre to 110-165 live trees/acre, depending on the Thinning Area (see Section 5.1.3, specific silvicultural prescriptions). This treatment will reduce competition and facilitate maintenance or increase in the growth rate of the remaining trees. Extensive data exists on tree densities and growth rates in Douglas-fir forests in the west Cascades (U.S. Forest Service 1974). Curves have been developed that delineate the maximum tree density, above which competition mortality occurs, and the minimum tree density, where the site is no longer considered completely forested (Figure 4). The ecological thinning treatment is designed to decrease the density to a point below the maximum curve where growth rate is expected to remain uninfluenced by competition for many years into the future. This should contrast with unthinned areas, where growth rate is expected to decrease from continued competition. To ensure larger diameter trees on the Unit, no trees greater than 13, 17, or 19 inches dbh (depending on the Thinning Area; see Section 5.1.3) will be cut during the ecological thinning.

Treatments to achieve Objective #2, Increase Structural Diversity
No ecological thinning will occur in Leave Areas 1-4, where there is more extensive root rot, older trees, and steeper slopes. This will maintain the current horizontal and vertical diversity and habitat elements, while providing for future diversity as the root rot slowly progresses. The juxtaposition of denser areas and gaps in the Leave Areas, with the varied leave tree densities in the Thinning Areas (see Section 5.1.3) will contribute to both biodiversity and heterogeneity at the forest stand scale. Retaining snags, CWD and shade tolerant conifers in the Thinning Areas will also retain structural complexity.

Ecological thinning will increase the light level to the forest floor, which is expected to facilitate tree and shrub establishment in the understory, leading to development of intermediate canopy layers and increasing vertical structural diversity. Thinning Areas 3 and 4 will be thinned more heavily than Thinning Areas 1 and 2 (see Section 5.1.3) to allow planting of a variety of tree species and facilitate shrub development. All emergent trees will be retained during the ecological thinning, which will also contribute to vertical diversity.

Treatments to achieve Objective #3, Increase Species Diversity
To improve species diversity, the ecological thinning will remove only Douglas-fir, with all other native species (including all hardwoods) retained. Reducing the density of trees will allow more light to reach the forest floor, which should enhance both understory tree initiation and growth, and deciduous shrubs that require greater amounts of light. Areas where species other than Douglas-fir predominate (e.g., the hill with big-leaf maple, and root rot pockets with western red cedar, hemlock, and vine maple in Leave Area 1) will be left undisturbed during ecological thinning to preserve species diversity. Planting with a variety of species in Thinning Areas 3 and 4 will increase tree species diversity (see Section 5.2.3.2).

Treatments to achieve Objective #4, Facilitate Maintenance and Recruitment of Large-Diameter Snags and CWD
In areas undergoing ecological thinning, all snags will be retained to the extent operationally feasible and within safety guidelines. Snags will be cut only to provide equipment access or meet safety regulations, and all cut snags will be left on site. Leave Areas 1-4 will allow competition mortality and the root rot process to continue to create small-diameter snags and a few larger snags as the stand matures. Current snag and CWD densities in Leave Area 1 are relatively high because of the root rot pockets. Maintaining the four Leave Areas as no-cut zones during the ecological thinning will allow them to continue to provide snag and CWD recruitment, although the expected lifetime of standing snags created by root rot is fairly short (on the order of five years). Once the snags fall, they will function as CWD on the forest floor. Ecological thinning should facilitate more rapid development of large-diameter trees, and subsequently large-diameter snags, as trees die through natural processes such as windthrow, lightning, and insects. It is expected that snags will continue to occur in patches across the Unit, a pattern that is seen in naturally functioning forest ecosystems.

Existing CWD will be retained on the forest floor during ecological thinning, although some may need to be relocated or cut to allow the thinning and planting operations. The largest trees (19" dbh) marked to be cut in Thinning Area 1 will be retained on the site as CWD. Retaining living, larger diameter trees and facilitating more rapid tree growth through the thinning will provide for future recruitment of larger snags and CWD in the long term. Creating larger snags from existing living large-diameter trees is not a priority in the Unit because of the current scarcity of larger trees and the high density of smaller snags in Leave Area 1. As with snags, CWD occurs naturally in patches, and is expected to continue in this pattern after intervention.

Treatments to achieve Objective #5, Protect Special Habitats
To maintain site heterogeneity, the wetland, higher productivity areas including the hill, patches of deciduous trees, and the root rot pockets (Leave Area 1) will be left undisturbed. Because the wetland is located in Leave Area 1, its hydrology will be protected, with the ecological thinning operation taking place no closer than 650 feet from the wetland. Although there are no streams on the site, both Walsh Lake Diversion Ditch and the Cedar River will be protected in that no ecological thinning will occur within 650 feet of the Ditch and 450 feet at the nearest point of the Cedar River. In

addition, no hauling of logs will be allowed on the 40 Road where it parallels the Walsh Lake Diversion Ditch.

Creating and maintaining the site in a mosaic of stand conditions and species will provide habitat for a greater number of wildlife species and foster natural biological diversity. In addition, increasing diversity and tree vigor will lessen the effect of the root rot, and assist in the development of late-successional characteristics.

Treatments to achieve Objective #6, Protect Water Quality
Although forage for elk is available near the Unit at the Hobart Landfill, interventions are not expected to increase the quantity or quality of forage habitat in the Unit. Given that the current canopy gaps are generally covered with shrubs and ferns, it is unlikely that retaining and creating canopy openings will result in increased grazing forage. Deer are primarily browsers that prefer deciduous shrubs, a food source that may increase in abundance following the heavier ecological thinning in Thinning Areas 3 and 4. The ratio of deciduous to evergreen shrubs is likely to remain low, however, because of low site quality and continuous canopy cover over the majority of the Unit. A possible increase in deciduous shrub forage is unlikely to significantly increase the local deer population.

5.1.3 Specific Thinning Prescriptions
To achieve the management objectives, the Unit (321 acres) was divided into eight areas based on various ecological variables such as tree density, tree diameter, hill slope, proximity to wetland, and existence of laminated root rot. To maintain horizontal patch variability across the Unit, four of the areas (157 acres) were designated as likely to benefit ecologically from thinning and four of the areas (164 acres) were designated as Leave Areas, which will not be thinned (Figure 1). The Leave Areas were so designated for a variety of reasons:

1) thinning in proximity to the wetland could create sudden environmental changes which could adversely impact the wetland (Leave Area 1);
2) maintaining the patchy dynamics of succession from non-resistant (e.g., Douglas-fir) to resistant tree species (e.g., western hemlock, red alder, western red cedar) in heavily infested regions of root rot (Leave Area 1);
3) maintaining regions with relatively large-diameter trees would not likely benefit from thinning (Leave Areas 1 and 2);
4) thinning on relatively steep slopes could increase the risk of soil erosion (Leave Area 3); and
5) establishing control areas (with no interventions) with which comparisons can be made over time (Leave Areas 1 and 4).

The areas that would potentially benefit from thinning required customized thinning prescriptions based on existing stand composition (Appendix II), specific objectives for each area, and the objective to create patches of varying tree density across the Unit. Prescriptions for each thinning area are addressed separately below. The general forest conditions before and projected after ecological thinning in each of the Thinning Areas are outlined in Table 3.

Table 3
Density of trees (per acre) for the ecological thinning of Thinning Units 1-4
in the 45 Road Forest Restoration Unit.

Thinning Area		1	2	3	4	Total
Acres		47	43	53	14	157
Current (before thin)	DF	209.9	215.9	150.1	191.0	191.7
	WH	9.5	6.0	8.3	3.4	6.8
	RC	0.0	2.3	0.0	0.0	0.6
	Total Live	219.4	224.3	158.5	194.4	199.1
	Quadratic Mean dbh (")	*12.0*	*12.5*	*12.6*	*12.5*	*12.4*
	DFD	4.8	3.2	12.2	40.7	15.2
	Total	224.2	227.5	170.6	235.1	214.4
Thinning Prescription		25% of BA applied to DF ≤19" dbh	25% of BA applied to DF ≤19" dbh	25% of BA applied to DF ≤17" dbh	25% of BA applied to DF ≤13" dbh	
Projected Thin	DF	61.7	61.3	45.0	71.3	56.8
	WH	0.0	0.0	0.0	0.0	0.6
	RC	0.0	0.0	0.0	0.0	0.0
	Total Live	61.7	61.3	45.0	71.3	57.4
	Quadratic Mean dbh (")	*11.2*	*11.8*	*11.4*	*10.1*	*11.3*
	DFD	0.0	0.0	0.0	≤37.3 downed*	3.3
	Total	61.7	61.3	45.0	71.3	60.7
Projected After Thin	DF	148.2	154.6	105.1	119.7	134.9
	WH	9.5	6.0	6.6	3.4	6.2
	RC	0.0	2.3	0.0	0.0	0.6
	Total Live	157.7	163.0	111.8	123.1	141.8
	Quadratic Mean dbh (")	*12.3*	*12.8*	*13.0*	*13.7*	*12.8*
	DFD	4.8	3.2	12.2	3.4 standing, ≤37.3 downed*	11.9
	Total	162.6	166.2	123.9	126.5	153.7

DF = Douglas-fir
WH = western hemlock
RC = western red cedar
DFD = dead Douglas-fir
*As many snags as feasible will be left standing. None will be removed from the site.

Ecological thinning will move the Thinning Areas away from competition mortality (e.g., the maximum tree density curve) towards a higher rate of growth (Figure 4).

While cutting standing dead trees (snags) is not specified in the prescriptions, some snags may be cut in order to comply with Washington State Department of Labor and Industry safety requirements, to protect worker safety during the thinning operation. Similarly, snags may have to be felled in Thinning Area 4 to allow equipment access for site preparation associated with restoration planting. Any snags that have to be cut will be retained on site as CWD. Competition mortality and root rot has created a significant amount of CWD throughout the Unit, although most of it is small diameter. All CWD currently on the ground will be left. Only additional CWD will be created in Thinning Area 1 during the ecological thinning, in addition to snags that must be felled for safety and access reasons.

No new roads will be built for the ecological thinning project. Although the thinning contract is still under development, the desired thinning equipment will consist of a cut-to-length processor and forwarder to minimize soil disturbance and damage to the remaining trees. Cut-to-length processors cut the trees, strip the branches on site, and move forward on paths cushioned by the branches, thereby minimizing soil disturbance and compaction. Processors are agile machines that minimize damage to soil and remaining trees because logs are not dragged along the ground or against trees. The processor piles logs which are then picked up by and loaded onto the forwarder that carries, but does not drag, the logs to a nearby road or landing. The turning radius of the processor is very tight, so no large landings are required, as are needed for cable yarding operations. Yarding surplus logs from the ecological thinning unit will be implemented with the minimum ground disturbance possible. All skid trails will be flagged by the contractor and approved by watershed staff before installation and use. Surplus logs will be moved to established roads to provide log trucks easy access and minimal turn-around needs.

5.1.3.1 Thinning Areas 1 and 2

Thinning Area 1 (47 acres), located in the south end of the Unit between the 43 Road, 45 Road, and the east-west topographic break, surrounds Leave Area 2, with its larger diameter trees (Figure 1). Thinning Area 2 (43 acres) is located east of the 43 Road, in closest proximity to the Cedar River. These two Thinning Areas have similar current forest conditions, so have been combined under one prescription. Site specific objectives are to 1) facilitate more rapid growth of large-diameter trees that will provide habitat and structural diversity while providing for future large-diameter snag and CWD recruitment, by decreasing tree density; 2) increase the relative proportion of other tree species by removing only Douglas-fir trees and retaining all other species; and 3) increase species and structural diversity by providing more light to the forest floor to encourage shrub and herbaceous species growth, and understory tree regeneration.

Based on a current tree density of 220-225 live trees per acre (Table 3 and Appendix II) and target density values of a more vigorously growing forest, approximately 62 live Douglas fir trees ≤19 inches dbh per acre will be harvested from Thinning Areas 1 and 2. This corresponds to 25 percent of the current total basal area of the Thinning Areas. All other tree species, including hardwoods, will be retained. This prescription will retain a forest stand of 155-165 live trees per acre. While this tree density should decrease competition and increase light to the forest floor, it is too dense to allow machine site preparation for planting. No planting will be done in these Areas, and understory tree and shrub species will be allowed to develop naturally. Additionally, in Thinning Area 1, those 19" dbh trees that are marked for cutting will be cut and left where felled as CWD. This CWD augmentation will add one large log or 2.6 tons of CWD per acre throughout Thinning Area 1.

Spacing between the leave trees was determined by the "diameter plus five feet" method with minimum and maximum spacing of 14 and 25 feet, respectively. Using this method, if the starting tree is 12 inches dbh, the next leave tree to be marked will be 17 feet away (12 feet plus 5 feet). This method allowed for a 20% variance in spacing to select for trees with the healthiest live crown. Selecting the healthiest trees will increase the chance that the trees will develop into large-diameter dominants. All take trees in Thinning Area 1 were marked on the uphill side with a ½ to ¾ inch circle of blue paint at breast height and two 3-inch blue paint spots at the base of the tree within one foot of the ground. This method allows the contract to be monitored for compliance. All leave trees in Thinning Area 2 were marked with orange paint using the same configuration.

5.1.3.2 Thinning Area 3

Thinning Area 3 (53 acres) is located in the northeast section of the Unit, between Leave Area 4 and Thinning Area 4. Specific objectives for this Area are to 1) increase tree species diversity by planting several different tree species; 2) establish a higher proportion of root rot resistant tree species by planting root rot resistant species; and 3) facilitate more rapid growth of large-diameter trees, that will provide habitat and structural diversity while providing for future large-diameter snag and CWD recruitment, by decreasing tree density.

Because the primary objective is to increase species diversity, Thinning Area 3 will be more heavily thinned than Thinning Areas 1 and 2, to facilitate planting. Based on a current tree density of almost 160 live trees per acre (Table 3 and Appendix II) roughly 45 Douglas-fir trees ≤17 inches dbh will be harvested per acre. This prescription will remove 25 percent of the current total basal area of the Area, and will retain a tree density of roughly 110 live trees per acre. This density will allow mechanical site preparation (needed because of the dense salal understory) for restoration planting (see Section 5.2).

Leave-tree spacing will average 21 feet utilizing the "diameter plus five feet" method (see Section 5.1.3.1). Take trees were marked with blue paint, in a manner consistent with Thinning Area 1.

5.1.3.3 Thinning Area 4

Thinning Area 4 (14 acres) is a small area that separates Thinning Area 3 from Leave Area 1. Specific objectives for Thinning Area 4 are the same as those described for Thinning Area 3 (see section 5.1.3.2).

As with Thinning Area 3, the primary objective is to increase species diversity. To facilitate planting, Thinning Area 4 will also be thinned more heavily than Thinning Areas 1 and 2. Based on a current live tree density of almost 195 live trees per acre (Table 3 and Appendix II), approximately 70 Douglas-fir trees ≤13 inches dbh will be harvested per acre from Thinning Area 4, with all larger diameter trees left. This corresponds to 25 percent of the current total basal area of the Area.

Since there is a high density of small diameter snags in Thinning Area 4, up to 37 snags per acre ≤14 inches dbh may be cut and placed on the ground as CWD, to clear the ground for site preparation and access for planting. The wood will be strategically placed to allow machine access during site preparation for planting. Of the ≤ 14 inch dbh snags to be cut, 76 percent are ≤9 inches dbh. Given the small area (14 acres) and the fact that small diameter snags are extremely numerous on the Unit, especially in the adjacent Leave Areas, the loss of these small diameter snags is not anticipated to have a significant effect on overall ecological structure or function in the Unit. Because the wood will be left on site, it will continue to function as CWD. Watershed scientists believe the benefit of increasing species diversity through planting (see Section 5.2) significantly outweighs the loss of some small diameter snags in this limited area.

All tree species other than Douglas-fir will be maintained through the thinning. This prescription will produce a forest with approximately 125 live trees per acre, plus those established through planting. Leave trees were selected amongst all available diameters ≥13 inches dbh, and were marked with orange paint in a manner consistent with the Thinning Area 2.

By having different prescriptions for the different Thinning Areas combined with the root rot process in Leave Area 1 and the denser forest in Leave Area 4, patches of differing tree densities will be created throughout the Unit, increasing patch diversity at the forest stand level.

5.2 Restoration Planting

5.2.1 Overview

The diversity of tree species of forests in the stem exclusion stage of forest development is often limited to those species that established most rapidly or grew most quickly during the stand initiation stage. Forests in the old-growth stage typically are much more diverse, largely due to the dynamics of the shifting mosaic where many tree species and age classes are able to exist in varying densities based on proximity to a seed source, shade tolerance, or other factors. Not only is the Unit currently dominated by Douglas-fir trees (Appendix II), but there is limited opportunity for other tree and shrub species to become established during the stem exclusion stage and due to the dominant salal understory. Diversifying the native tree species on the site via planting following ecological thinning will move the forest stand toward the more biologically diverse understory reinitiation stage with the introduction of another cohort of trees.

Douglas-fir is susceptible to laminated root rot, which is extensive on the site. Though root rot will increase the horizontal diversity of the stand by creating gaps in the forest canopy, there is no readily available short-term source of seeds of root rot resistant tree species to colonize many of these gaps. A dense understory of salal also minimizes germination substrate necessary for seedlings to establish themselves. Planting root rot resistant and immune species will help introduce another cohort of trees in patches where the Douglas-fir trees have died or have been ecologically thinned.

5.2.2 Treatments

Treatments to achieve Objective #3, Increase Species Diversity

Native tree species other than Douglas-fir will be established or enhanced during the restoration planting in Thinning Areas 3 and 4. These species may include root rot resistant or immune species such as western red cedar, western white pine (*Pinus monticola*), bigleaf maple, and red alder. Establishing root rot resistant species will increase the forest diversity and complexity.

Treatments to achieve Objective #4, Facilitate Maintenance and Recruitment of Snags and CWD

Planting Thinning Areas 3 and 4 with relatively short-lived hardwoods, such as red alder, will help provide snags over the intermediate term. This will also contribute to future horizontal diversity (gaps) on the Unit, as the hardwood trees die, become snags and eventually CWD, creating canopy openings where other species can then become established.

Treatments to achieve Objective #6, Protect Water Quality

No grazing forage will be planted on the Unit, so elk will not be encouraged to more heavily utilize the area.

5.2.3 Specific Planting Prescriptions

To achieve the upland restoration planting objectives, root rot resistant tree species will be planted in areas where the post-thinning tree density is appropriate for the cultivation of seedlings (e.g., sufficient light penetration), and there is sufficient access for mechanized site preparation. These areas will include Thinning Areas 3 and 4 (67 acres total), where ecological thinning prescriptions are designed to promote potential planting sites by increasing light to the forest floor and providing machine access needed for the site preparation. Several factors were taken into consideration in choosing mechanical site preparation methods, including: 1) the extremely dense salal understory and root structure indicated that, compared with machine preparation, hand methods would be ineffective and likely result in decreased survival of the seedlings due to root competition; 2) mechanical methods would be more efficient and cost-effective on this site; and 3) mechanical methods will not cause substantial compaction due to the gravelly nature of the soil.

5.2.3.1 Site Preparation

The thinning density in Thinning Areas 3 and 4 will allow the use of a hydraulic rototiller designed to remove competing vegetation while aerating the soil without mixing the soil layers. The resulting plantable spot is a 3-foot diameter circle of bare soil, which should sufficiently reduce root competition with the salal to allow high seedling survival. The rototiller will create an average of 100 plantable spots per acre. Root damage of healthy trees will be avoided by not preparing sites within 10 feet of their canopy "drip line". If trees show signs of stress (e.g., a chlorotic condition) and do not appear that they will survive into the long term, then plantable spots can occur in closer proximity. This will allow shade-tolerant understory trees to establish and grow slowly under the canopy, with the expectation that their growth will increase once the overstory tree dies and becomes a snag. This should provide both species diversity and increased vertical diversity as the understory trees grow at different rates due to light availability.

5.2.3.2 Planting

The plantable spots created during the site preparation will be planted with a variety of species including western red cedar, western white pine, bigleaf maple, and red alder. These species are tolerant (pine), resistant (cedar), or immune (maple and alder) to laminated root rot (Thies and Sturrock 1995). The droughty soil on the Unit indicates larger seedling stock types will have a greater chance for survival, including seedlings with an abundantly proportionate root mass to tops, averaging 30-45 cm (12-18 in.) in length, and a stem caliper of at least 5mm (0.2 in.). Good stock types include Plug +2, 1+1, and 2+1.

Seedlings will be planted during January to April following the ecological thinning. A survival survey of the seedlings will be done in the fall or early winter of the year in which planting occurs. Replanting or spot planting, if needed, will occur during the following planting season. Long-term survival of the seedlings may require multiple treatments of competing understory vegetation. These treatments would be accomplished by hand.

5.3 Future Silvicultural Treatments

It is not anticipated that future silvicultural treatments will be required. The site will be monitored following ecological thinning and restoration planting, however, and adaptive management decisions, including whether additional silvicultural treatments would be ecologically beneficial, will be based on the monitoring data.

6.0 MONITORING

6.1 Compliance Monitoring

Because all leave (Thinning Areas 2 and 4) or take (Thinning Areas 1 and 3) trees were marked, the City maintained maximum control over what will be cut. In addition, a trained monitor will be on site daily during the ecological thinning, planting site preparation, and planting operations, to ensure that contract specifications are followed. Compliance monitoring will also include a post-thinning timber cruise both to validate the projected tree densities of the thinning areas and to serve as the baseline for future monitoring in the thinned areas. This post-thinning cruise will occur within one year of the ecological thinning.

6.2 Effectiveness Monitoring

Because of the experimental nature of the ecological thinning treatment and the fact that the Unit is representative of over 3,000 acres of similar forest, it is essential that responses to the restoration interventions are monitored. This will allow scientists to adaptively apply what is learned on the Unit to portions of the remaining forest to accelerate this low elevation forest toward late-successional habitat. Success in achieving the objectives will be evaluated using a combination of monitoring techniques and measurements (Table 4).

Table 4

Monitoring techniques used to evaluate the success in achieving the management objectives in the 45 Road Forest Restoration Unit.

Objective	Monitoring Technique, Measurement
Maintain or Increase Growth Rate of Trees	Compare increment cores, dbh, height, percent live crown, and height to lowest live limb on representative trees in vegetation and control plots
Increase Structural Diversity	Compare height, height to lowest live limb, crown width, percent live crown, and presence of epicormic branching in vegetation and control plots. Compare relative bat use in thinned and leave areas.
Increase Plant Species Diversity	Compare overstory (tree) species and density in vegetation and control plots. Compare understory (shrub, fern and herbaceous vegetation) species presence and percent cover in vegetation and control plots. Document planted seedling survival and growth.
Facilitate Maintenance and Recruitment of Large-Diameter Snags and CWD	Compare snag and CWD density, diameter, height or length, and decay class in vegetation and control plots. Compare relative bat use in thinned and leave areas.
Protect Special Habitats	During ecological thinning and planting operations, ensure no equipment enters the wetland or any of the Leave Areas.
Protect Water Quality	Monitor standard water quality measures at the municipal water supply intake at the Landsburg Diversion Dam.

Initial overstory conditions in Thinning Areas 1-4 were estimated by the 2001 timber cruise (80 plots represented in Appendix II). Of these plots, ten will be geo-referenced, remeasured and established as vegetation monitoring plots for the ecological thinning and planting (five in Thinning Areas 1 and 2, and five in Thinning Areas 3 and 4). Three control plots will be established in Leave Area 1, to allow comparison of naturally developing heterogeneity and species diversity through the root rot process with the results of the ecological thinning and restoration planting. An additional three control plots will be established in Leave Area 4, to allow comparison of the ecological thinning with a densely stocked area with root rot levels comparable to Thinning Areas 1 and 2. One control plot will be established in Leave Area 3.

Plot layout will utilize the design for Permanent Sample Plots in CRW (Seattle Public Utilities Permanent Sample Plot Implementation Plan 2002). This includes fixed circular plots for trees, snags, and tall shrubs (1/10, 1/5, or 4/10 ac, depending on tree density) and seedlings (1/1000, 1/300, or 1/100 ac depending on seedling size). Shrubs and ferns will be measured in $4m^2$ plots, herbaceous vegetation in $1m^2$ plots, and CWD on four 25m transects.

Rapid responses to the restoration treatments are not expected, so vegetation will be monitored on the 20 plots at one and ten years after the ecological thinning and planting. Results will be reported in Effectiveness Monitoring Reports and will be used to establish the subsequent monitoring schedule (likely every ten to 15 years until HCP year 50). This level of monitoring should allow evaluation of the successional trajectory and whether the objectives delineated in this management plan are being achieved.

Effectiveness monitoring for planting will additionally include evaluation of seedling survival and growth at the end of the first, second, third, and fifth growing seasons. Seedling survival monitoring reports will document these results, and be attached as appendices to the Effectiveness Monitoring Reports.

Watershed scientists anticipate that implementation of the management actions specified in this plan will accelerate development of a naturally functioning late-successional forest that requires no further management actions. Monitoring may or may not indicate that future management actions, such as further ecological thinning, restoration planting, or creation of snags or CWD, are warranted to achieve the management objectives. The benefit of future actions will be weighed against the impacts of repeated entry on natural communities.

6.3 Validation Monitoring

Certain wildlife species can serve as indicators of forest composition, structure and function. Their presence or level of activity in the Unit may validate that the objective of accelerating late-successional forest characteristics with respect to wildlife use is being achieved.

Forest-dwelling bats use large-diameter snags and the thick or peeling bark of older trees for maternity colonies, as well as for day and night roosts. They forage in more open areas, such as gaps found in old growth. Bat activity was found to be significantly higher (2.5 to 9.8 times as much activity) in old-growth forest (>200 years) than in mature and young unmanaged forest stands (35-195 years) (Thomas and West 1991). No bats were detected in managed 30-40 year old closed canopy stands in a 2-year study (Erickson 1997). As such, bats may be useful indicator species to evaluate late-successional conditions.

This Unit will be used as an experimental site to test the assumption that bats can be used as an indicator of late-successional conditions on poor growing sites. Baseline bat presence and relative use of Thinning Areas 1-4 and Leave Area 1 was conducted in June-August 2002, by recording the ultrasonic calls using an ultrasonic detecting and recording devise (Titley Electronics). Little or no bat use was found in Thinning Areas 1-4. Bats were present on the Unit, however, and used the small wetland extensively, especially when water was present. Moderate use was detected in the root rot pockets and on the hill in Leave Area 1. Monitoring for bat use of different gap sizes continued during the summer of 2002. Bat calls will be analyzed during winter 2002-2003 to identify species or species groups. Monitoring both the Thinning Areas and Leave Area 1 will occur within five years of the ecological thinning and restoration planting, to determine if the density of leave trees provide habitat suitable for bat use.

Monitoring frequency will then occur coincident with vegetation monitoring, and results will be included in the Effectiveness Monitoring Reports.

7.0 IMPLEMENTATION AND DOCUMENTATION

7.1 Seattle City Council Ordinance

The ecological thinning process requires the approval of the Seattle City Council through an ordinance. The ordinance specifically allows the sale of surplus trees, and was approved in December 2002. A copy of the ordinance is attached as Appendix III to this plan.

7.2 Contracts

7.2.1 Ecological Thinning Contract

Following the approval of the ordinance by the Seattle City Council, the City will contract out the ecological thinning work to a qualified contractor. The contract will be sold to the highest bidder that meets specific qualifications. A copy of the contract will be attached as an appendix to this plan. The thinning is expected to take place in 2003, with an estimated 677 thousand board feet (MBF) of surplus trees removed from the Unit. Proceeds from the thinning will help fund other HCP activities, likely including cultural resources surveys and monitoring that has occurred or will occur in this Unit, as well as third party certification of sustainably managed forests, and other cultural resource studies. If the contract does not sell, the prescriptions in this plan will not be modified, but the Unit may be added to another ecological thinning unit in the future.

7.2.2 Restoration Planting Contract

Following the ecological thinning, City staff will evaluate the environmental conditions for restoration planting in the Unit. It is likely that planting site preparation work will be contracted to an appropriate reforestation company through a service contract using existing funding. The actual planting work may or may not be out-sourced, depending on a cost/benefit analysis of doing this work in house. It is expected that the planting will be conducted in the spring of 2004.

7.3 Project Completion

A short report will be prepared, if needed, to describe any instances where field prescriptions were modified during implementation. The reasons for such modification will be described. Details such as skid trail locations and planted seedling source and type will be recorded. The data from the post-treatment cruise will be included in this project completion report.

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9.0 GLOSSARY

Adaptive management	As applied in the CRW-HCP, the process of adaptive management is defined with three basic elements: (i) an initial operational decision or project design made in the face of uncertainty about the impacts of the action; (ii) monitoring and research to determine impacts of actions; and (iii) changes to operations or project design in response to new information.
Basal area	The cross sectional area of a tree at breast height, usually summed by species over a given area.
Biodiversity	Biological diversity; the combination and interactions of genetic diversity, species composition, and ecological diversity (including factors such as age, form, structure, and location) in a given place at a given time.
Biological legacies	As defined in the CRW-HCP: Features of a previous forest that are retained at timber harvest or left after natural disturbances, including old-growth or other large diameter snags, stumps, live trees, logs, soil communities, hardwood trees, and shrubs. Also referred to as legacies.
Board feet	A measurement of lumber volume. A board foot is equal to 144 cubic inches of wood.
Canopy	The cover of branches and foliage formed collectively by the crowns of trees or other growth. Also used to describe layers of vegetation or foliage below the top layer of foliage in a forest, as when referring to the multi-layered canopies or multi-storied conditions typical of ecological old-growth forests.
Canopy closure	The degree to which the boles, branches, and foliage (canopy) block penetration of sunlight to the forest floor or obscures the sky; determined from measurements of density (percent closure) taken directly under the canopy.
Cedar River Watershed	An administrative unit of land owned by the City of Seattle for the purposes of providing a municipal water supply. The 90,546-acre municipal watershed within the upper part of the Cedar River Basin lies upstream from the City's water intake at Landsburg Diversion Dam. It is composed of eight major subbasins and 27 subbasins, 26 of which drain into the Cedar River. It supplies about 2/3 of the drinking water to Seattle Public Utilities' water service area.

Chalcedony	A form of a cryptocrystalline (crystals of sub-microscopic size) quartz. There are two main varieties: chalcedony, which is uniformly colored, and agate, which is characterized by curved bands or zones of differing color.
Competitive exclusion	A phase in which the canopy closes and competition among trees becomes intense in a developing stand. Also sometimes called stem exclusion.
Compliance monitoring	Monitoring performed to determine whether contracts are implemented as written.
Decay class	One of five recognizable stages of wood decay as a fallen tree decomposes and is reincorporated into the soil. Factors that categorize stages of decay include bark and twig presence or absence, log texture and shape, wood color, position relative to the ground, and presence or absence of invading roots (Maser and Trappe 1984).
Debitage	The by-products of stone tool manufacture, usually small flakes and shattered pieces of rock.
Diameter at breast height (dbh)	The diameter of a tree, including bark, measured 4.5 ft above the ground on the uphill side of the tree and measured in inches.
Disturbance	Significant change in forest structure or composition through natural events (such as fire, flood, wind, earthquake, or disease) or human-caused events (forest management).
Ecological thinning	As defined in the CRW-HCP: The experimental silvicultural practice of cutting, damaging, or otherwise killing some trees from some areas of older, overstocked, second-growth forest (typically over 30 years old). The intent of ecological thinning is to encourage development of the habitat structure and heterogeneity typical of late-successional and old-growth stands, characterized by a high level of vertical and horizontal stand structure, and to improve habitat quality for wildlife. It is expected that techniques will include variable-density thinning to create openings, develop a variety of tree diameter classes, develop understory vegetation, and recruit desired species; and creating snags and logs by uprooting trees, felling trees, topping trees, injecting trees with decay-producing fungus, and other methods. Ecological thinning does not have any commercial objectives. However, in those cases in which an excess of woody material is generated by felling trees, trees may be removed from the thinning site and may be sold or used in

	restoration projects on other sites.
Effectiveness monitoring	Monitoring to determine whether implemented restoration activities result in anticipated habitat conditions or effects on species.
Even-aged forest	A forest with minimal differences in age, generally less than 10 years, between trees.
Forest Stand	A group of trees that possess sufficient uniformity in composition, structure, age, spatial arrangement, or condition to distinguish them from adjacent groups of trees. Also referred to as stand.
Forest succession	The sequential change in composition, abundance, and patterns of species that occurs as a forest matures after an event in which most of the trees are removed. The sequence of biological communities in a succession is called a sere, and the communities are called seral stages.
Habitat	The sum total of environmental conditions of a specific place occupied by plant or animal species or a population of such species. A species may require or use more than one type of habitat to complete its life cycle.
Habitat Conservation Plan (HCP)	As defined under Section 10 of the federal Endangered Species Act, a plan required for issuance of an incidental take permit for a listed species. Called "conservation plans" under the Act, HCPs can address multiple species, both listed and unlisted, and can be long term. HCPs provide for the conservation of the species addressed, and provide certainty for permit applicants through an implementation agreement between the Secretary of the Interior or Secretary of Commerce and a non-federal entity.
Interior forest conditions	Forest conditions that are largely not affected by edge effects, which occur where large openings abut the forest. Edge effects that are know to occur in some areas include penetration of light and wind, temperature changes, and increased predator activity. Interior forest condition are achieved at sufficient distance from an edge so that edge effects are minimal.
Jasper	A variety of chalcedony (a form of quartz) that is heavily impregnated with iron compounds to produce an opaque red, reddish-brown, or brown color.

Landsburg Diversion Dam	The low dam at the site of the diversion for uptake of drinking water operated by Seattle Public Utilities, located at River Mile 21.8 of the Cedar River. As a run-of-the-river dam, it does not create a significant impoundment of water upstream. Also referred to as Landsburg Dam.
Late-successional forest	Forest in the later stages of forest succession; the sequential change in composition, abundance, and patterns of species that occurs as a forest matures. As used in the CRW-HCP, refers to conifer forests 120-189 years of age. Characterized by increasing biodiversity and forest structure, such as a number of canopy layers, large amounts of coarse woody debris, light gaps (canopy openings), and developed understory vegetation.
Legacies	See biological legacies.
Listed wildlife species, federal	Under the federal Endangered Species Act, species, or sub-unit of a species, formally listed in the Federal Register as endangered or threatened by the Secretary of the Interior or the Secretary of Commerce. A listing refers to the species or sub-unit by scientific and common name and specifies over what portion of its range it is endangered or threatened.
Lithic artifact	Artifacts where the raw material is stone. These include artifacts that are manufactured by chipping, grinding, or battering. This class of artifacts also includes artifacts that are not necessarily manufactured, but are identifiable as artifacts by the presence of observable cultural modification (battering on cobble hammers). Other lithic artifacts that are not utilitarian, but may have served a significant cultural function are also included, such as crystals, fossils, and polished pebbles.
Loess	A geologic term that refers to deposits of silt (sediment with particles 2-64 microns in diameter) that were laid down by wind action.
Management prescriptions	A set of procedures designed to accomplish a specific management objective.
Monitoring	The process of collecting information to evaluate if objectives and anticipated results of a management plan are being realized or if implementation is proceeding as planned. This may include assessing the effects upon a species' habitat.

Native species	Any wildlife species naturally occurring in a specific area of Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state; defined by WAC 232-12-297.
Old-growth conditions	Conditions in older conifer forest stands, with vertical and horizontal structural attributes sufficient to maintain some or all of the ecological functions of natural "ecological old-growth" forest, which is typically at least 200 years old and often much older.
Old-growth forest	As used in the CRW-HCP, native unharvested conifer forest in the Cedar River Municipal Watershed that is at least 190 years of age, but which does not necessarily exhibit "ecological old-growth" conditions.
Pressure flake	A stone tool-making technique whereby flakes are detached from the tool by applying leverage (pressure) to an edge. An antler tine, piece of bone, or hard wood sharpened for accurate application of force is often used for flake removal. Downward and outward pressure pops the flakes off. This method can straighten and sharpen edges of a finished tool or shape a tool from flake to final form.
Restoration planting	Planting of native trees, shrubs, and other plants to encourage development of habitat structure and heterogeneity, to improve habitat conditions for fish and wildlife, and to accelerate development of old-growth conditions or riparian forest function in previously harvested second growth.
Second-growth	Forest stands in the process of regrowth after an earlier cutting or disturbance.
Seral stage	A particular stage (ecological community) in a sere, or pattern of succession. As used in the CRW-HCP, applies to forest succession
Silviculture	The theory and practice of controlling the establishment, composition, growth, and quality of forest stands in order to achieve management objectives. Includes such actions as thinning, planting, fertilizing, and pruning.
Site index	The total height to which dominant trees of a given species will grow on a given site at some index age, often 50 or 100 years

Slope	A measure of the steepness of terrain, equal to the tangent of the angle of the average slope surface with the horizontal, expressed in percent. A 100 percent slope has an angle with the horizontal of 45 degrees, a 70% slope has an angle of 35 degrees, and a 30 percent slope has an angle of 17 degrees.
Snag	A standing dead tree.
Species	A unit of the biological classification system (taxonomic system) below the level of genus; a group of individual plants or animals (including subspecies and populations) that have common attributes and are capable of interbreeding. The federal Endangered Species Act defines species to include subspecies and any "distinct population segment" or "evolutionarily significant unit" of any species.
Stand	See forest stand.
Take	To harass, harm, pursue, hunt, wound, kill, trap, capture, or collect a federally listed threatened or endangered species, or to attempt to do so (ESA, Section 3[10]). Take is prohibited under federal law, except where authorized. Take may include disturbance of the listed species, nest, or habitat when disturbance is extensive enough to disrupt normal behavioral patterns for the species, although the affected individuals may not actually die.
Threatened species, federal	A designation as defined in the federal Endangered Species Act for a species that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.
Type F waters	Perennial fish-bearing streams, as defined in WAC 222-16-030.
Type S waters	Shorelines of the state, as under chapter 90.58 RCW, in WAS 222-16-030.
Type 1-3 waters	In the context of the HCP, fish bearing waters. Definition based on WAC 222-16-031.
Validation Monitoring	Monitoring to determine cause and effect relationships, such as that between habitat and species.

Walsh Lake Diversion Ditch	An approximately 4 mile-long channel constructed in the early 1930s to redirect the drainage waters from Walsh Lake (within the Cedar River Municipal Watershed) to a point in the Cedar River downstream of the Landsburg Diversion Dam and drinking water intake structures. Also referred to as Walsh Lake Ditch or Walsh Ditch.
Washington Administrative Code (WAC)	All current, permanent rules of each state agency, adopted pursuant to chapter 34.05 RCW.
Watershed	A basin contributing water, organic matter, dissolved nutrients, and sediments to a stream, lake, or ocean. As applied in the CRW-HCP, used to refer to the Cedar River Municipal Watershed above the Landsburg Diversion Dam and water intake, some of which does not drain into the Cedar River above the Landsburg water intake.
Wetland	Land where the water table is usually at or near the surface or the land is covered by shallow water and has one or more of the following attributes: the land supports, at least periodically, predominantly hydrophytic plants (plants adapted to water or waterlogged soil); substrate is predominantly undrained hydric soils; and/or the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season each year.

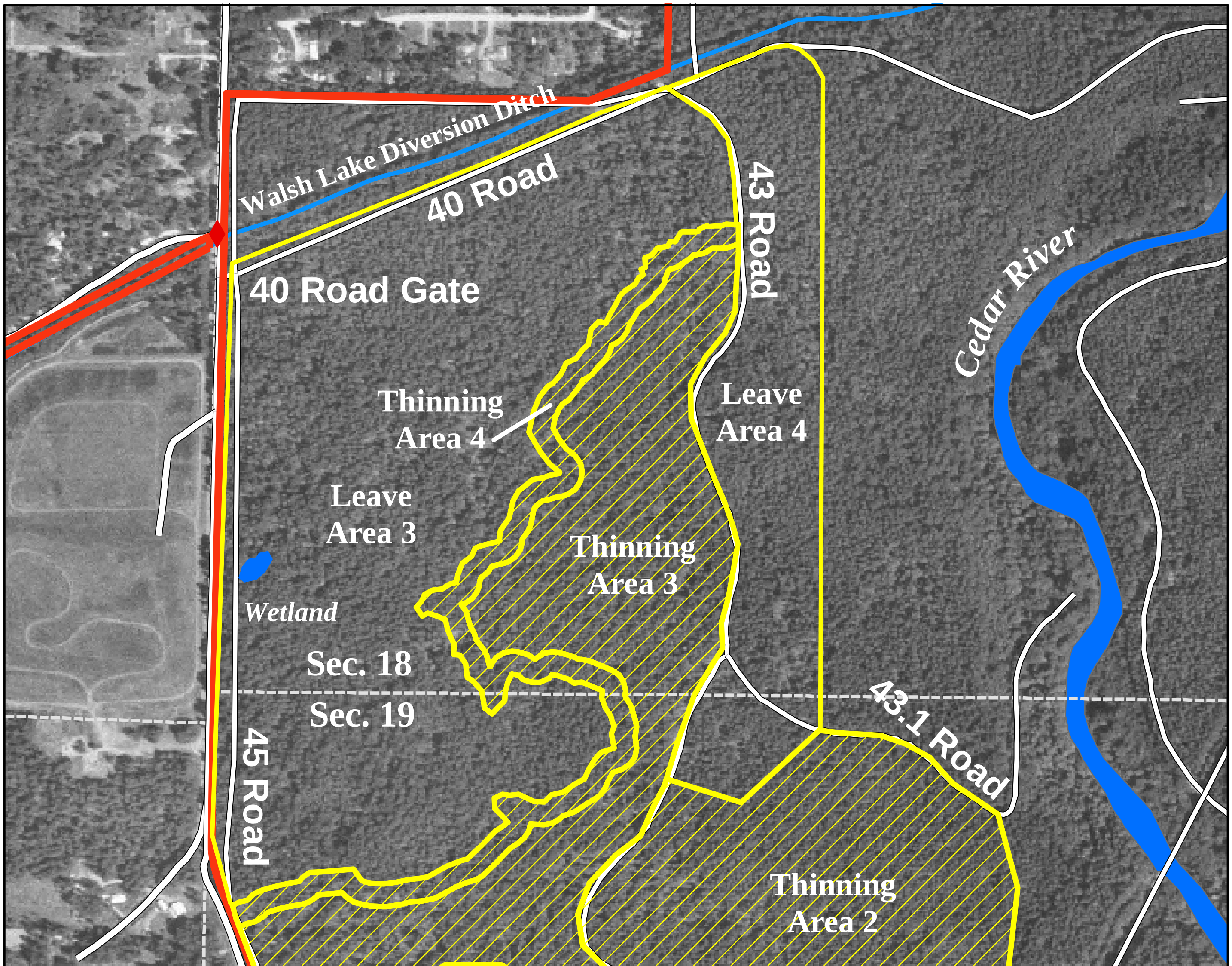


Figure 1. 45 Road Forest Restoration Unit, with Thinning and Leave Areas
T22N, R7E, Sections 18 and 19

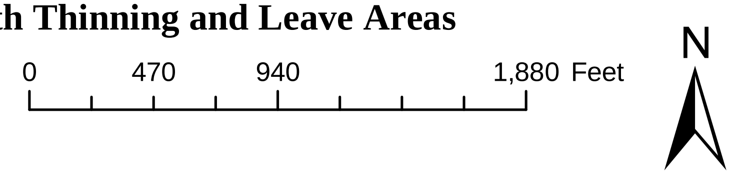
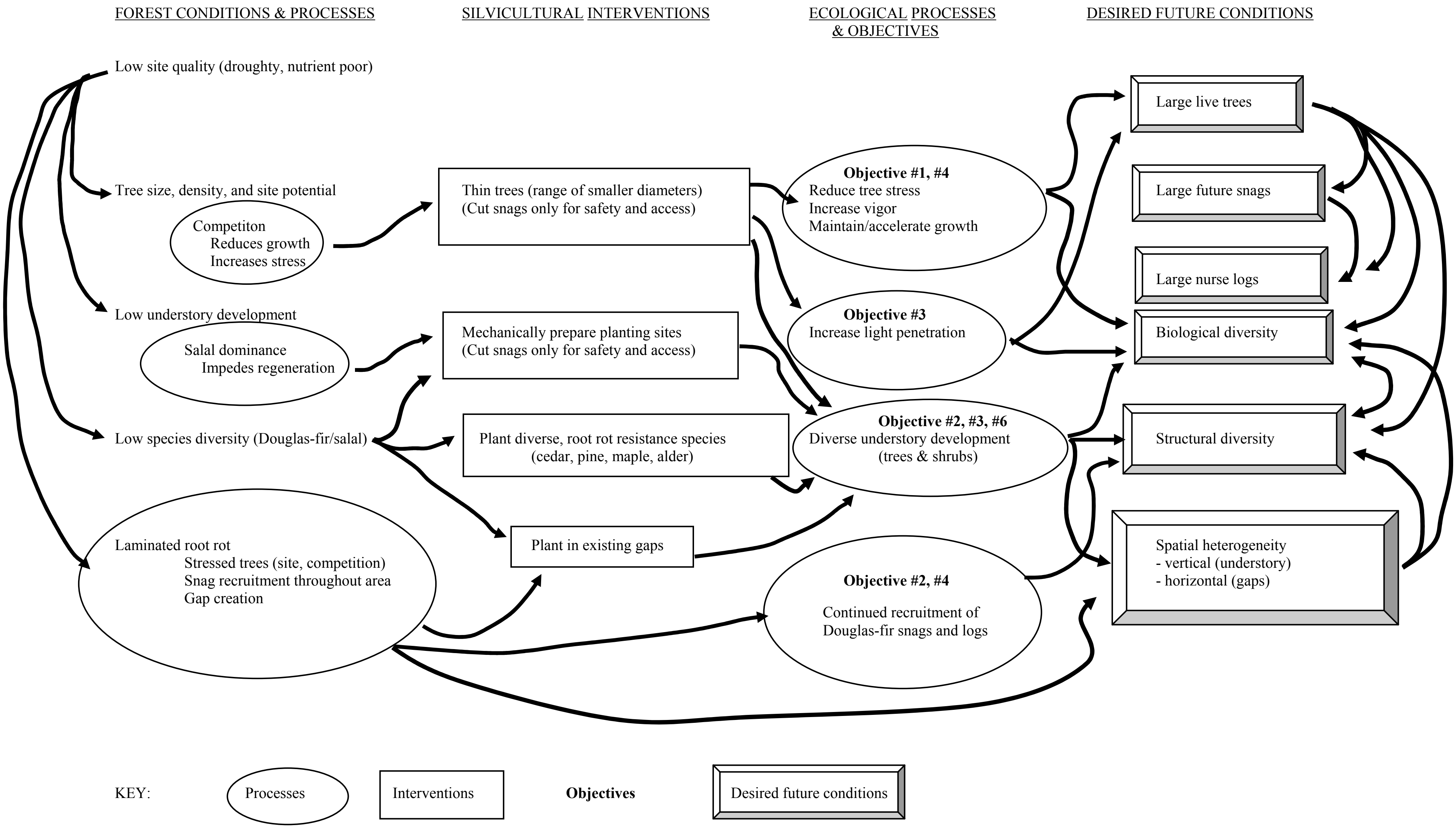


Figure 2. Vicinity of the 45 Road Forest Restoration Unit

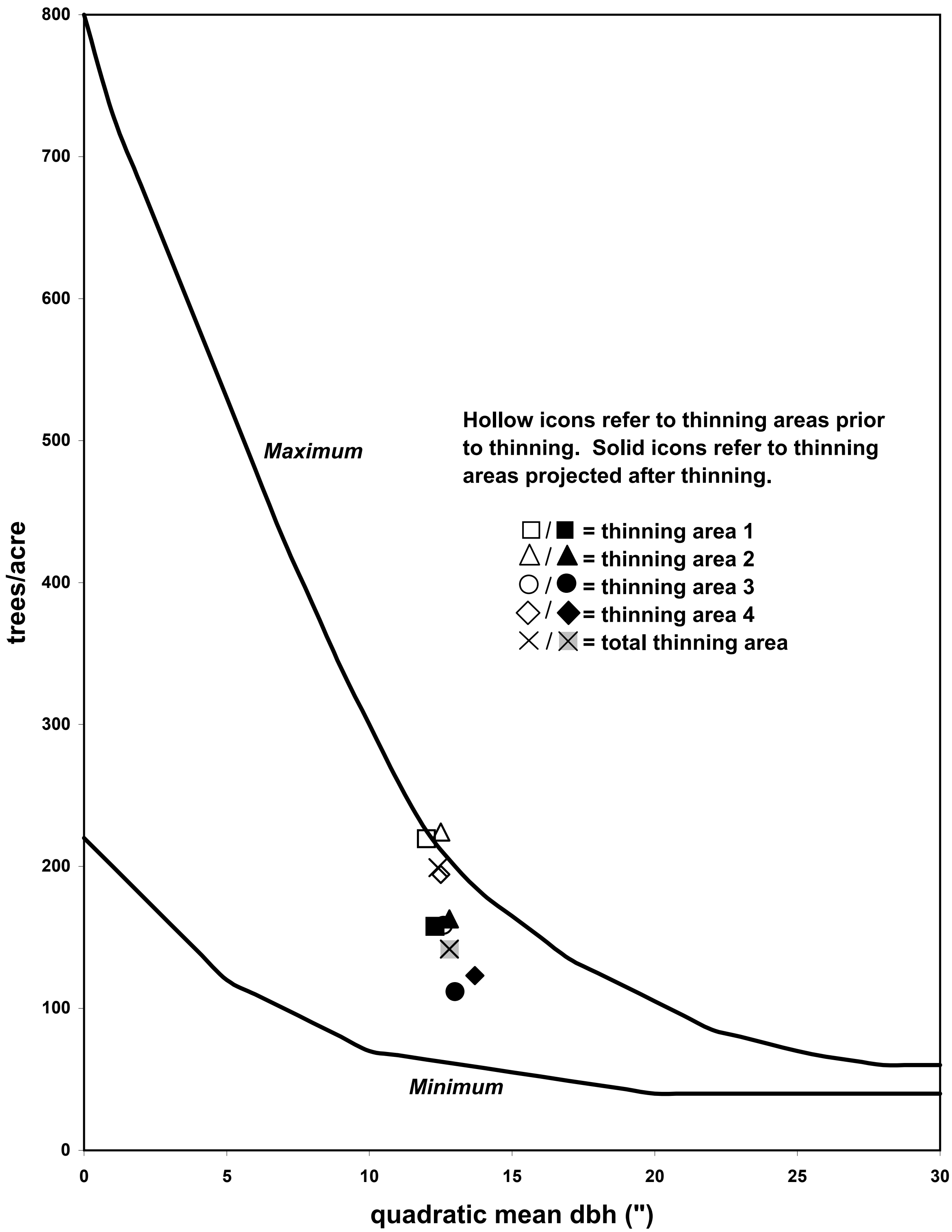
Figure 3. Forest Vegetative Conditions, Processes and Interventions in Thinning Areas 1-4

45 Road Forest Restoration Unit, Cedar River Watershed



NOTE: Objective #5 is addressed through delineation of Leave Areas.

Figure 4. Tree Density Curves
Douglas-fir Forests in the Western Cascades



Appendix I. List of wildlife species potentially occurring in the 45 Road Forest Restoration Unit (CRW-HCP designated species of concern are in italics).

Group	Species	Key Habitat Elements	Potential Occurrence: Uplands: Current	Uplands: Late-successional	Aquatic: Streams	Aquatic: Wetlands
Invertebrates	*Carabid Beetles (3 species)*	Wetlands				X
	Mistletoe Hairstreak	Hemlock with dwarf mistletoe		X		
	Blue-gray Taildropper	Mature conifer, large CWD, moist areas		X		
	Oregon Megomphix	Mature conifer, large CWD, moist areas		X		
	Puget Oregonian	Mature conifer, hardwood, large CWD, moist areas		X		
Amphibians	*Northern Red-legged Frog*	Mature conifers, wetlands, ponds, large CWD	X	X		X
	Long-toed Salamander	Dry conifer forest, wetlands, ponds	X	X		X
	Northwestern Salamander	Mature conifer, large CWD, wetlands, ponds	X	X		X
	Pacific Giant Salamander	Large CWD, mature conifer, snags	X	X	X	
	Roughskin Newt	Mature conifer, hardwoods, wetlands, large CWD	X	X		X
	Western Redback Salamander	Mature conifer, large CWD, hardwoods	X	X		
	Western Toad	Open water, wetlands	X	X		X
	Pacific Tree Frog	Wetlands, ponds, shrubs, CWD	X	X		X
Birds	*Brown Creeper*	Large conifers (Douglas-fir), snags, mature hardwoods, wetlands, western white pine		X		X
	Vaux's Swift	Snags, large conifers, hardwoods, wetlands		X		X
	Olive-sided Flycatcher	Mature conifers, snags, hardwoods, wetlands, edges, high emergent perches, proximity of open areas		X		X
	Merlin	Large trees near open fields	X	X		
	Rufous Hummingbird	Shrubs, vines, conifers, hardwoods, near open areas	X	X		
	Pileated Woodpecker	Snags, large conifers	X	X		
	Band-tailed Pigeon	Berry-producing shrubs, conifers, hardwoods	X	X		
	Marbled Murrelet	Large branches, large conifers		X		
	Northern Spotted Owl	Large conifers		X		
	Northern Goshawk	Snags, large conifers		X		
	Sharp-shinned Hawk	Mixed conifer-hardwoods	X	X		
	Coopers Hawk	Hardwoods	X	X		
	Northern Pygmy Owl	Snags	X	X		
	Northern Saw-whet Owl	Snags, conifers, wetlands	X	X		X
	Western Screech Owl	Snags	X	X		
	Great Horned Owl	Snags		X		
	Northern Flicker	Snags	X	X		
	Hairy Woodpecker	Large conifers, large snags, western white pine	X	X		
	Downy Woodpecker	Hardwoods, wetlands, snags	X	X		X

Appendix I. List of wildlife species potentially occurring in the 45 Road Forest Restoration Unit (CRW-HCP designated species of concern are in italics).

Group	Species	Key Habitat Elements	Potential Occurrence: Uplands: Current	Potential Occurrence: Uplands: Late-successional	Potential Occurrence: Aquatic: Streams	Potential Occurrence: Aquatic: Wetlands
	Red-breasted Sapsucker	Mixed conifer-hardwoods, snags	X	X		
	Pacific Slope Flycatcher	Large cedar & hemlock, hardwoods, berry producing shrubs, snags	X	X		
	Hammond's Flycatcher	Conifers		X		
	Gray Jay	Shrubs	X	X		
	Stellers Jay	Shrubs	X	X		
	Chestnut-backed Chickadee	Large conifers (especially cedar), large snags, large amounts of foliage, downed wood, canopy breaks	X	X		
	Bushtit	Shrubs, deciduous trees	X			
	Red-breasted Nuthatch	Snags, large conifers, vine maple,	X	X		
	Golden-crowned Kinglet	Large amounts of foliage, closed canopy, large conifers, hardwoods		X		
	Winter Wren	Shrubs, conifers, hardwoods, CWD, stumps	X			
	Swainson's Thrush	Berry-producing shrubs, hardwoods, CWD	X	X		
	Varied Thrush	Large conifers, shrubs,CWD, berry producing shrubs	X	X		
	Black-throated Gray Warbler	Large amounts of foliage, hardwoods	X	X		
	Wilson's Warbler	Canopy gaps, snags, conifers, hardwoods, shrubs	X	X		
	Orange-crowned Warbler	Edges, shrubs	X	X		
	Hermit/Townsend Warbler	Large amounts of foliage, hardwoods, conifers	X	X		
	Black-headed Grosbeak	Deciduous trees, mixed conifer-hardwoods	X	X		
	Dark-eyed Junco	Shrubs, CWD	X	X		
	Western Tanager	Large amounts of foliage, hardwoods	X	X		
	Pine Siskin	Conifers, mixed conifer-hardwood	X	X		
	Purple Finch	Conifer, mixed conifer-hardwood	X	X		
Mammals	*Masked Shrew*	Hardwoods (alder and willow), CWD, wetlands	X	X		X
(Insectivores)	Montane Shrew	Large CWD, deciduous & evergreen shrubs	X	X		
	Trowbridge Shrew	Large CWD	X	X		
	Shrew-Mole	Large CWD	X	X		
(Rodents)	Mountain Beaver	Shrubs, ferns, conifers, hardwoods, grasses	X	X		
	Common Porcupine	Hollow trees, snags, rocks, herbaceous plants	X	X		
	Deer Mouse	Deciduous shrubs, hardwoods, downed wood. open areas, edges	X	X		
	Forest Deer Mouse	Mature conifers, large CWD	X	X		
	Pacific Jumping Mouse	Open areas, edges	X	X		

Appendix I. List of wildlife species potentially occurring in the 45 Road Forest Restoration Unit (CRW-HCP designated species of concern are in italics).

Group	Species	Key Habitat Elements	Potential Occurrence: Uplands: Current	Potential Occurrence: Uplands: Late-successional	Potential Occurrence: Aquatic: Streams	Potential Occurrence: Aquatic: Wetlands
	Southern Red-backed Vole	Hardwoods, fungus, lichen	X	X		
	Long-tailed Vole	Edges, grasses	X	X		
	Creeping Vole	Open areas, grasses, deciduous shrubs	X	X		
	Townsend Chipmunk	Open areas, edges	X	X		
	Douglas Squirrel	Conifers, fungus	X	X		
	Northern Flying Squirrel	Fungus, lichen, conifers, snags, downed wood, shrubs		X		
(Rabbits)	Snowshoe Hare	Wetlands	X	X		X
(Bats)	*Big Brown Bat*	Snags, hardwoods, conifers, wetlands, open water		X	X	X
	California Myotis	Snags, mature conifers, hardwoods, wetlands, open water	X	X	X	X
	Hoary Bat	Snags, mature conifers, edges, hardwoods, openings, open water		X	X	X
	Little Brown Myotis	Snags, wetlands, open water, mature conifers		X	X	X
	Long-eared Myotis	Snags, young and mature conifer, hardwoods, deciduous shrubs, open water	X	X	X	X
	Long-legged Myotis	Snags, young and mature conifers, hardwoods, open	X	X	X	X
	Townsend's Big-eared Bat	Snags, mature conifer, edges, open areas		X		
	Yuma Myotis	Snags, mature conifers, wetlands, open water, open areas		X	X	X
	Silver-haired Bat	Snags, mature conifers, open water, hardwoods		X	X	X
(Ungulates)	Elk	Grasses, herbaceous material, dense cover	X	X		
	Deer	Shrubs, dense cover	X	X		
(Carnivores)	*Martin*	Snags, CWD, rock outcrops		X		
	Bobcat	Large CWD, rock piles	X	X		
	Red Fox	Large CWD, berry-producing shrubs	X	X		
	Coyote	Berry-producing shrubs	X	X		
	Black Bear	CWD, root wads, snags	X	X		
	Striped Skunk	Large CWD, rock piles	X	X		
	Spotted Skunk	Large CWD, rock piles	X	X		
	Mink	Wetlands	X	X		X
	Long-tailed Weasel	Wetlands, large CWD	X	X		X
	Short-tailed Weasel	Wetlands, large CWD	X	X		X

Appendix II. Tree data by species, from 2001 cruise data, 45 Road Forest Restoration Unit Thinning Areas

All Thinning Areas Combined (157 acres)

BA = basal area; BF = board feet

Size	Douglas Fir			Western Hemlock			Western Redcedar			Dead Douglas Fir			Total Live			Total		
(dbh)	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac
6	11.197	2.10	43	0.000	0.00	0	0.000	0.00	0	3.355	0.57	0	11.197	2.10	43	14.552	2.67	43
7	14.646	3.74	358	1.079	0.29	22	0.000	0.00	0	2.196	0.59	44	15.725	4.03	380	17.921	4.62	424
8	22.694	7.40	738	0.897	0.28	18	0.000	0.00	0	0.000	0.00	0	23.591	7.68	756	23.591	7.68	756
9	17.906	7.71	769	0.000	0.00	0	0.000	0.00	0	2.827	1.18	98	17.906	7.71	769	20.733	8.89	867
10	20.678	10.73	1,059	1.159	0.63	35	0.582	0.32	17	0.620	0.34	25	22.419	11.68	1,111	23.039	12.02	1,136
11	13.511	8.70	1,029	1.244	0.80	75	0.000	0.00	0	1.205	0.80	84	14.755	9.50	1,104	15.960	10.30	1,188
12	17.307	13.19	1,647	0.852	0.61	68	0.000	0.00	0	2.470	1.84	174	18.159	13.80	1,715	20.629	15.64	1,889
13	13.934	12.54	1,642	0.000	0.00	0	0.000	0.00	0	0.673	0.57	67	13.934	12.54	1,642	14.607	13.11	1,709
14	16.870	17.42	2,446	0.590	0.61	92	0.000	0.00	0	0.421	0.42	38	17.460	18.03	2,538	17.881	18.45	2,576
15	9.460	11.18	1,544	0.000	0.00	0	0.000	0.00	0	0.512	0.59	51	9.460	11.18	1,544	9.972	11.77	1,595
16	10.298	14.15	2,045	0.215	0.30	52	0.000	0.00	0	0.202	0.28	26	10.513	14.45	2,097	10.715	14.73	2,123
17	6.473	10.08	1,594	0.358	0.56	72	0.000	0.00	0	0.407	0.62	79	6.831	10.64	1,666	7.238	11.26	1,745
18	5.279	9.07	1,396	0.000	0.00	0	0.000	0.00	0	0.340	0.60	58	5.279	9.07	1,396	5.619	9.67	1,454
19	2.973	5.72	948	0.164	0.32	54	0.000	0.00	0	0.000	0.00	0	3.137	6.04	1,002	3.137	6.04	1,002
20	2.541	5.42	946	0.141	0.31	47	0.000	0.00	0	0.000	0.00	0	2.682	5.73	993	2.682	5.73	993
21	2.334	5.50	997	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	2.334	5.50	997	2.334	5.50	997
22	0.897	2.31	439	0.114	0.30	52	0.000	0.00	0	0.000	0.00	0	1.011	2.61	491	1.011	2.61	491
23	0.570	1.63	351	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.570	1.63	351	0.570	1.63	351
24	0.945	2.93	551	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.945	2.93	551	0.945	2.93	551
25	0.261	0.86	185	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.261	0.86	185	0.261	0.86	185
26	0.222	0.81	178	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.222	0.81	178	0.222	0.81	178
27	0.366	1.45	316	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.366	1.45	316	0.366	1.45	316
28	0.134	0.56	115	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.134	0.56	115	0.134	0.56	115
29	0.126	0.58	118	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.126	0.58	118	0.126	0.58	118
30	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
31	0.056	0.28	57	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.056	0.28	57	0.056	0.28	57
32	0.053	0.29	60	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.053	0.29	60	0.053	0.29	60
Total	191.731	156.35	21,571	6.813	5.01	587	0.582	0.32	17	15.228	8.40	744	199.126	161.68	22,175	214.354	170.08	22,919

Thinning Area 1 (47 acres)

BA = basal area; BF = board feet;

25% of the total live tree BA will be removed from the shaded a

Size	Douglas Fir			Western Hemlock			Western Redcedar			Dead Douglas Fir			Total Live			Total		
(dbh)	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac
6	5.240	1.03	52	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	5.240	1.03	52	5.240	1.03	52
7	25.539	6.48	633	4.316	1.15	86	0.000	0.00	0	0.000	0.00	0	29.855	7.63	719	29.855	7.63	719
8	35.185	11.74	1,182	3.589	1.10	72	0.000	0.00	0	0.000	0.00	0	38.774	12.84	1,254	38.774	12.84	1,254
9	25.250	10.77	981	0.000	0.00	0	0.000	0.00	0	2.436	1.08	97	25.250	10.77	981	27.686	11.85	1,078
10	22.842	11.99	783	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	22.842	11.99	783	22.842	11.99	783
11	12.824	8.61	816	1.594	1.05	64	0.000	0.00	0	1.594	1.05	64	14.418	9.66	880	16.012	10.71	944
12	15.658	11.92	1,454	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	15.658	11.92	1,454	15.658	11.92	1,454
13	16.842	15.17	1,963	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	16.842	15.17	1,963	16.842	15.17	1,963
14	9.406	9.81	1,324	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	9.406	9.81	1,324	9.406	9.81	1,324
15	8.283	9.71	1,316	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	8.283	9.71	1,316	8.283	9.71	1,316
16	8.204	11.10	1,493	0.000	0.00	0	0.000	0.00	0	0.807	1.13	105	8.204	11.10	1,493	9.011	12.23	1,598
17	5.546	8.61	1,310	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	5.546	8.61	1,310	5.546	8.61	1,310
18	4.355	7.63	1,216	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	4.355	7.63	1,216	4.355	7.63	1,216
19	3.434	6.58	1,096	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	3.434	6.58	1,096	3.434	6.58	1,096
20	3.071	6.53	1,145	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	3.071	6.53	1,145	3.071	6.53	1,145
21	2.324	5.48	1,015	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	2.324	5.48	1,015	2.324	5.48	1,015
22	0.864	2.23	406	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.864	2.23	406	0.864	2.23	406
23	0.382	1.10	206	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.382	1.10	206	0.382	1.10	206
24	2.253	7.03	1,205	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	2.253	7.03	1,205	2.253	7.03	1,205
25	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
26	0.590	2.18	394	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.590	2.18	394	0.590	2.18	394
27	0.571	2.23	471	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.571	2.23	471	0.571	2.23	471
28	0.270	1.15	208	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.270	1.15	208	0.270	1.15	208
29	0.503	2.31	473	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.503	2.31	473	0.503	2.31	473
30	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
31	0.222	1.13	229	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.222	1.13	229	0.222	1.13	229
32	0.213	1.13	239	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.213	1.13	239	0.213	1.13	239
Total	209.871	163.65	21,610	9.499	3.30	222	0.000	0.00	0	4.837	3.26	266	219.370	166.95	21,832	224.207	170.21	22,098

Thinning Area 2 (43 acres)
BA = basal area; BF = board feet;
25% of the total live tree BA will be removed from the shaded area species size classes.

Size	Douglas Fir			Western Hemlock			Western Redcedar			Dead Douglas Fir			Total Live			Total		
(dbh)	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac
6	5.738	1.13		0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	5.738	1.13	0	5.738	1.13	0
7	9.340	2.15	187	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	9.340	2.15	187	9.340	2.15	187
8	32.711	10.55	1,106	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	32.711	10.55	1,106	32.711	10.55	1,106
9	32.106	13.92	1,471	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	32.106	13.92	1,471	32.106	13.92	1,471
10	20.239	10.69	1,372	1.973	1.08	59	2.329	1.27	70	0.000	0.00	0	24.541	13.04	1,501	24.541	13.04	1,501
11	10.301	6.39	908	3.380	2.13	235	0.000	0.00	0	3.225	2.13	274	13.681	8.52	1,143	16.906	10.65	1,417
12	22.600	17.08	2,404	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	22.600	17.08	2,404	22.600	17.08	2,404
13	11.913	10.72	1,375	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	11.913	10.72	1,375	11.913	10.72	1,375
14	23.488	24.47	3,576	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	23.488	24.47	3,576	23.488	24.47	3,576
15	7.140	8.54	1,326	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	7.140	8.54	1,326	7.140	8.54	1,326
16	9.407	13.06	2,037	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	9.407	13.06	2,037	9.407	13.06	2,037
17	8.922	14.00	2,405	0.667	1.05	80	0.000	0.00	0	0.000	0.00	0	9.589	15.05	2,485	9.589	15.05	2,485
18	4.471	7.59	1,262	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	4.471	7.59	1,262	4.471	7.59	1,262
19	4.570	8.82	1,560	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	4.570	8.82	1,560	4.570	8.82	1,560
20	5.331	11.37	2,025	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	5.331	11.37	2,025	5.331	11.37	2,025
21	3.724	8.79	1,720	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	3.724	8.79	1,720	3.724	8.79	1,720
22	0.427	1.13	222	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.427	1.13	222	0.427	1.13	222
23	1.483	4.23	974	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	1.483	4.23	974	1.483	4.23	974
24	1.137	3.48	747	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	1.137	3.48	747	1.137	3.48	747
25	0.309	1.05	250	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.309	1.05	250	0.309	1.05	250
26	0.297	1.05	320	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.297	1.05	320	0.297	1.05	320
27	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
28	0.267	1.10	254	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.267	1.10	254	0.267	1.10	254
29	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
30	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
31	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
32	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
Total	215.921	181.31	27,501	6.020	4.26	374	2.329	1.27	70	3.225	2.13	274	224.270	186.84	27,945	227.495	188.97	28,219

Thinning Area 3 (53 acres)

BA = basal area; BF = board feet;
25% of the total live tree BA will be removed from the shaded area species size classes.

Size	Douglas Fir			Western Hemlock			Western Redcedar			Dead Douglas Fir			Total Live			Total		
(dbh)	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac
6	6.408	1.26		0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	6.408	1.26	0	6.408	1.26	0
7	23.704	6.33	612	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	23.704	6.33	612	23.704	6.33	612
8	8.518	2.61	301	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	8.518	2.61	301	8.518	2.61	301
9	8.829	3.75	406	0.000	0.00	0	0.000	0.00	0	2.915	1.29	117	8.829	3.75	406	11.744	5.04	523
10	20.728	10.44	1,232	2.661	1.45	80	0.000	0.00	0	2.480	1.35	99	23.389	11.89	1312	25.869	13.24	1,411
11	16.507	10.51	1,272	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	16.507	10.51	1272	16.507	10.51	1,272
12	8.803	6.56	804	0.000	0.00	0	0.000	0.00	0	3.444	2.71	310	8.803	6.56	804	12.247	9.27	1,114
13	5.983	5.29	786	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	5.983	5.29	786	5.983	5.29	786
14	11.599	11.72	1,584	2.360	2.43	366	0.000	0.00	0	1.684	1.67	152	13.959	14.15	1950	15.643	15.82	2,102
15	9.912	11.81	1,499	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	9.912	11.81	1499	9.912	11.81	1,499
16	8.017	11.00	1,475	0.861	1.20	207	0.000	0.00	0	0.000	0.00	0	8.878	12.20	1682	8.878	12.20	1,682
17	8.389	13.07	1,890	0.763	1.20	206	0.000	0.00	0	1.628	2.49	314	9.152	14.27	2096	10.780	16.76	2,410
18	3.602	6.15	929	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	3.602	6.15	929	3.602	6.15	929
19	2.657	5.16	655	0.654	1.29	216	0.000	0.00	0	0.000	0.00	0	3.311	6.45	871	3.311	6.45	871
20	1.762	3.78	613	0.564	1.23	186	0.000	0.00	0	0.000	0.00	0	2.326	5.01	799	2.326	5.01	799
21	2.216	5.14	825	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	2.216	5.14	825	2.216	5.14	825
22	1.388	3.61	675	0.455	1.20	210	0.000	0.00	0	0.000	0.00	0	1.843	4.81	885	1.843	4.81	885
23	0.417	1.20	225	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.417	1.20	225	0.417	1.20	225
24	0.391	1.23	254	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.391	1.23	254	0.391	1.23	254
25	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
26	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
27	0.316	1.26	241	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.316	1.26	241	0.316	1.26	241
28	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
29	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
30	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
31	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
32	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
Total	150.146	121.88	16,278	8.318	10.00	1,471	0.000	0.00	0	12.151	9.51	992	158.464	131.88	17,749	170.615	141.39	18,741

Thinning Area 4 (14 acres)

BA = basal area; BF = board feet;

25% of the total live tree BA will be removed from the shaded area species size classes.

Size	Douglas Fir			Western Hemlock			Western Redcedar			Dead Douglas Fir			Total Live			Total		
(dbh)	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac	trees/ac	BA/ac	BF/ac
6	27.400	4.99	120	0.000	0.00	0	0.000	0.00	0	13.420	2.30		27.400	4.99	120	40.820	7.29	120
7	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	8.785	2.35	176	0.000	0.00	0	8.785	2.35	176
8	14.363	4.70	362	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	14.363	4.70	362	14.363	4.70	362
9	5.437	2.40	217	0.000	0.00	0	0.000	0.00	0	5.958	2.35	179	5.437	2.40	217	11.395	4.75	396
10	18.904	9.81	851	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	18.904	9.81	851	18.904	9.81	851
11	14.411	9.29	1,120	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	14.411	9.29	1,120	14.411	9.29	1,120
12	22.167	17.19	1,925	3.408	2.46	273	0.000	0.00	0	6.437	4.64	386	25.575	19.65	2,198	32.012	24.29	2,584
13	20.999	18.97	2,443	0.000	0.00	0	0.000	0.00	0	2.693	2.30	269	20.999	18.97	2,443	23.692	21.27	2,712
14	22.986	23.67	3,301	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	22.986	23.67	3,301	22.986	23.67	3,301
15	12.507	14.67	2,033	0.000	0.00	0	0.000	0.00	0	2.047	2.35	205	12.507	14.67	2,033	14.554	17.02	2,238
16	15.562	21.43	3,176	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	15.562	21.43	3,176	15.562	21.43	3,176
17	3.037	4.64	773	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	3.037	4.64	773	3.037	4.64	773
18	8.689	14.91	2,176	0.000	0.00	0	0.000	0.00	0	1.359	2.40	231	8.689	14.91	2,176	10.048	17.31	2,407
19	1.230	2.30	480	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	1.230	2.30	480	1.230	2.30	480
20	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
21	1.071	2.58	429	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	1.071	2.58	429	1.071	2.58	429
22	0.910	2.30	455	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.910	2.30	455	0.910	2.30	455
23	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
24	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
25	0.734	2.40	492	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.734	2.40	492	0.734	2.40	492
26	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
27	0.577	2.30	554	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.577	2.30	554	0.577	2.30	554
28	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
29	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
30	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
31	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
32	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0	0.000	0.00	0
Total	190.984	158.55	20,907	3.408	2.46	273	0.000	0.00	0	40.699	18.69	1,446	194.392	161.01	21,180	235.091	179.70	22,626

Appendix III. Council Bill #114421, Ordinance #121039, Approved by the Water and Health Committee on December 10, 2002, passed by the full Seattle City Council on December 16, 2002, and signed by the Mayor on December 20, 2002.

AN ORDINANCE relating to the Cedar River Watershed; authorizing an "ecological thinning" project, in accordance with the Cedar River Watershed Habitat Conservation Plan (HCP), in Sections 18 and 19, Township 22 North, Range 7 East, W.M.; declaring the logs resulting from said project to be surplus to the City's needs; authorizing the sale of such logs pursuant to applicable City contracting or surplus property sale procedures; and directing deposit of the proceeds therefrom to the Water Fund for the purposes of HCP implementation.

Date introduced/referred: Nov 25, 2002
Date passed: Dec 16, 2002
Status: Passed
Vote: 7-0 (Excused: Nicastro, Steinbrueck)
Date of Mayor's signature: Dec 20, 2002

Committee: Water and Health
Sponsor: PAGELER

Index Terms: THREATENED-AND-ENDANGERED-SPECIES, WATERSHEDS, FISH, ENVIRONMENTAL-PROTECTION, TREES, TIMBER, SALES, TIMBERLANDS, CEDAR-RIVER, WATER-SUPPLY, FORESTS

References/Related Documents: Related: Ord 114632, CB 114422; Related: Res 29977, Ord 117928
Note: Ecological Thinning

Text

Note to users: {- indicates start of text that has been amended out
-} indicates end of text that has been amended out
{+ indicates start of text that has been amended in
+} indicates end of text that has been amended in

AN ORDINANCE relating to the Cedar River Watershed; authorizing an "ecological thinning" project, in accordance with the Cedar River Watershed Habitat Conservation Plan (HCP), in Sections 18 and 19, Township 22 North, Range 7 East, W.M.; declaring the logs resulting from said project to be surplus to the City's needs; authorizing the sale of such logs pursuant to applicable City contracting or surplus property sale procedures; and directing deposit of the proceeds therefrom to the Water Fund for the purposes of HCP implementation.

WHEREAS, in 1999, following several years of technical studies, negotiations with federal and state agencies and review by public groups and individuals, the City Council adopted Resolution 29977 authorizing the Mayor to submit the Final HCP and other related documents for federal review and issuance of an "incidental take permit" under the federal Endangered Species Act, and to execute on behalf of the City the HCP and related agreements, which together establish the City's long-term commitments regarding watershed habitat protection and mitigation for impacts resulting from the presence and operation of certain City owned facilities; and

WHEREAS, the HCP describes, among other subjects, the City's planned forest management practices, including the use of "ecological thinning" to accelerate development of old-growth conditions, improve habitat for species dependent on older forest, and control risks of catastrophic events in certain existing densely-stocked second-growth stands; and

WHEREAS, in 2000, the City received the incidental take permit and executed the HCP and related agreements; and

WHEREAS, in 2002, Council Bill ________ clarified certain differences between the forest management policies contained in the Secondary Use Policies (adopted by Ordinance 114632) and those contained in the HCP; prohibited the harvesting of trees for commercial purposes on City-owned land within the Watershed; authorized the cutting of trees for certain limited non-commercial reasons (including ecological thinning); provided limited authority for the sale of logs resulting from such non-commercial cutting; and dedicated the proceeds from such sales for the purpose of offsetting the costs of the HCP; and

WHEREAS, following field surveys and other technical considerations, Watershed staff have recommended for the first ecological thinning project under the HCP a second-growth stand located in Sections 18 and 19, Township 22 North, Range 7 East, W.M., and consisting of approximately 286 acres, of which approximately 157 acres will receive thinning treatment; and

WHEREAS, this planned ecological thinning project is estimated to result in up to 761,000 board feet of merchantable logs, among the vegetation that would be cut; NOW THEREFORE,

BE IT ORDAINED BY THE CITY OF SEATTLE AS FOLLOWS:

Section 1. The Director of Seattle Public Utilities is hereby authorized to contract, pursuant to applicable City contracting or surplus property sale procedures, and subject to the right of first refusal granted to Mountain Tree Farm Company by the 1962 Cedar River Watershed Cooperative Agreement, for the service of ecological thinning of a second-growth forest stand located in Sections 18 and 19, Township 22 North, Range 7 East, W.M. and consisting of approximately 286 acres, of which approximately 157 acres will receive thinning treatment under the principles and procedures described in the Cedar River Watershed Habitat Conservation Plan (HCP), which contract may provide for the sale and removal of merchantable logs down as a result of such ecological thinning. A public hearing having been held, the logs resulting from the ecological thinning project authorized by this Ordinance are hereby declared to be surplus to the City's needs. The Director of Seattle Public Utilities is further authorized to conduct all related monitoring, surveys and other such activities as may be required by the City's commitments in the HCP and by applicable permit requirements.

Section 2. All proceeds from the sale of logs authorized by Section 1 of this ordinance shall be deposited in the Water Fund and further dedicated for the exclusive purpose of offsetting the costs of implementing the HCP, including the projects, programs and activities described in the HCP documents and those that educate the public about them.

Section 3. Any act taken pursuant to the authority and prior to the effective date of this ordinance is hereby ratified and confirmed.

Section 4. This ordinance shall take effect and be in force thirty (30) days from and after its approval by the Mayor, but if not approved and returned by the Mayor within ten (10) days after presentation, it shall take effect as provided by Municipal Code Section 1.04.020.

Passed by the City Council the _____ day of _______________, 20___, and signed by me in open session in authentication of its passage this _____ day of _______________, 20___.

____

President ____________of the City Council

Approved by me this _____ day of _______________, 20___.

____

Gregory J. Nickels, Mayor

Filed by me this _____ day of _______________, 20___

____

City Clerk

9/6/2002

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